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Arsenic Removal from Drinking Water by Coagulation/Filtration U.S. EPA Demonstration Project at Town of Arnaudville, LA Final Performance Evaluation Report

by

Abraham S.C. Chen§
Wendy E. Condit†
Brian J. Yates†
Lili Wang§

†Battelle, Columbus, OH 43201-2693
§ALSA Tech, LLC, Powell, OH 43065-6938

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Thomas J. Sorg
Task Order Manager

Water Supply and Water Resources Division
National Risk Management Research Laboratory
Cincinnati, Ohio 45268

National Risk Management Research Laboratory
Office of Research and Development
U.S. Environmental Protection Agency
Cincinnati, Ohio 45268

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Sally Gutierrez, Director
National Risk Management Research Laboratory

ABSTRACT

This report documents the activities performed during and the results obtained from the arsenic removal treatment technology demonstration project at the United Water Systems' facility in Arnaudville, LA. The objectives of the project were to evaluate: (1) the effectiveness of Kinetico's FM-284-AS pressure filtration system using Macrolite® media in removing arsenic to meet the maximum contaminant level (MCL) of 10 μg/L, (2) the reliability of the treatment system for use at small water facilities, (3) the required system operation and maintenance (O&M) and operator skill levels, and (4) the capital and O&M cost of the technology. The project also characterized water in the distribution system and residuals generated by the treatment process. The types of data collected included system operation, water quality, process residuals, and capital and O&M cost.

Upon approval of the engineering plan by the Louisiana Department of Health and Hospitals (LADHH), the treatment system was installed and became operational on June 23, 2006. The system consisted of a 5,000-gal contact tank (converted from a pre-existing aeralater) and two 84-in × 96-in steel pressure tanks configured in parallel. Each pressure tank was loaded with 75 ft^3 of Macrolite® media, a spherical, low density, and chemically inert ceramic media, to which filtration rates up to 10 gpm/ft^2 (at a design flowrate of 770 gal/min [gpm]) might be applied (the actual flowrate was 335 gpm [on average]). Due to the presence of ammonia (1.9 mg/L [as N]) and total organic carbon (TOC) (1.3 mg/L) in source water, potassium permanganate ($KMnO_4$) was selected as the oxidant to oxidize As(III) (24.4 μg/L [on average]) and Fe(II) (1,906 μg/L [on average]). After arsenic-laden iron solids had been removed by the pressure filters, the treated water was softened, with 30% bypass, and chlorinated before entering the distribution system.

Source water was supplied by two 10-in production wells, i.e., Wells No. 1 and No. 2, at 350 and 375 gpm, respectively. Quality of well water from both wells was similar, containing 24.1 to 43.0 μg/L of arsenic (existing mostly as soluble As[III]), 1,477 to >3,000 μg/L of iron (existing almost entirely in the soluble form), and 96.2 to 196 μg/L of manganese (also existing almost entirely in the soluble form).

Because the aeralater was used not only as a contact tank, but also for aeration (although unintentionally), a number of operational and performance issues occurred during the performance evaluation study. After approximately five months into system operation, extensive biofouling became evident, causing the filters to be backwashed up to eight times per day (from one to two times per day after system startup). Aeration in the aeralater, with an average dissolved oxygen (DO) level of 5.5 mg/L, apparently had caused biological activities, including nitrification, to occur. To curb continuing biological activities in the filters, several actions were taken, including performing a hydrochloric acid (HCl)/caustic wash of the filter media, replacing $KMnO_4$ with gas chlorine, and turning off the blower of the aeralator. Due to the presence of elevated soluble As(V) in the filter influent/effluent, a system modification application package was prepared and submitted to LADHH for supplemental iron addition. While the benefit of supplemental iron usage was inconclusive, extra solids loading to the filters caused them to be backwashed more frequently (from one to two times per day to two to three times per day). Iron addition was discontinued after 19 months.

Although the ratio of soluble iron to soluble arsenic in source water was over 65 (on average) — a value higher than the rule-of-thumb value of 20 — elevated soluble As(V) (close to or over 10 μg/L) continued to be measured through the most of the 4-year study period. Factors affecting removal of soluble As(V) in the filter influent might include elevated phosphorus levels (648 μg/L [on average]), elevated silica levels (42.5 mg/L [as SiO_2] [on average]), and elevated DO levels due to aeration in the aeralater. Aeration continued even after shutting-down of the blower (DO levels reduced from 5.5 to 2.4–3.4 mg/L) and removal of aluminum trays (DO levels further reduced to 2.4 mg/L). Aeration discontinued only after

the aeralater had been bypassed (DO levels further reduced to 0.5 mg/L). The presence of oxygen might have caused some soluble iron to precipitate (even though $KMnO_4$ or chlorine was added ahead of the aeralater), rendering it ineffective to remove soluble As(V) via adsorption and/or co-precipitation. A series of jar tests were conducted onsite to examine the authenticity of this postulation.

Results of distribution system water sampling before and after system startup indicated that the water quality in the distribution system was comparable to that of the pressure filter effluent. Thus, the treatment system appeared not to have beneficial effects on arsenic, iron, and manganese concentrations. Arsenic concentrations remained essentially unchanged from baseline levels; iron and manganese concentrations actually increased slightly. Alkalinity, pH, and lead concentrations also increased slightly. Copper concentrations increased rather significantly from the average baseline level of 108 μg/L to 267 μg/L.

Analyses of backwash wastewater samples indicated that approximately 4.9 lb of solids (including 0.01 lb of arsenic, 1.8 lb of iron, and 0.08 lb of manganese) would be disharged, assuming that 87.8 mg/L of total suspended solids (TSS) and 6,752 gal of wastewater would be generated during each backwash event.

The capital investment for the treatment system was $427,407, including $281,048 for equipment, $50,770 for site engineering, and $95,589 for installation, shakedown, and startup. Using the system's rated capacity of 770 gpm (or 1,108,800 gal/day [gpd]), the capital cost was $555/gpm (or $0.38/gpd). This calculation did not include the cost of the building to house the treatment system. O&M cost, estimated at $0.07/1,000 gal, included only the incremental cost for chemicals, electricity, and labor. Since chlorine addition already existed prior to the demonstration study, the incremental cost for chemical usage was for iron addition only.

CONTENTS

APPENDICES

FIGURES

TABLES

ABBREVIATIONS AND ACRONYMS

Δp	differential pressure
AAL	American Analytical Laboratories
Al	aluminum
AM	adsorptive media
As	arsenic
ATS	Aquatic Treatment Systems
C/F	coagulation/filtration
Ca	calcium
Cl	chlorine
CRF	capital recovery factor
Cu	copper
DBP	Disinfection Byproducts
DI	deionized
DO	dissolved oxygen
EPA	U.S. Environmental Protection Agency
F	fluoride
Fe	iron
$FeCl_3$	ferric chloride
GFH	granular ferric hydroxide
gpd	gallons per day
gph	gallons per hour
gpm	gallons per minute
HAA	heloacetic acid
HIX	hybrid ion exchanger
hp	horsepower
ICP-MS	inductively coupled plasma-mass spectrometry
ID	identification
IX	ion exchange
LADHH	Louisiana Department of Health and Hospitals
LCR	(EPA) Lead and Copper Rule
MCL	maximum contaminant level
MDL	method detection limit
MEI	Magnesium Elektron, Inc.
Mg	magnesium
µm	micrometer
Mn	manganese
mV	millivolts
Na	sodium

NA	not analyzed
NaOCl	sodium hypochlorite
ND	not detected
NRMRL	National Risk Management Research Laboratory
NS	not sampled
NSF	NSF International
NTU	nephelometric turbidity units
O&M	operation and maintenance
OIP	operator interface panel
OIT	Oregon Institute of Technology
OPH	Office of Public Health
ORD	Office of Research and Development
ORP	oxidation-reduction potential
P	phosphorus
Pb	lead
pCi/L	picocuries per liter
psi	pounds per square inch
psig	pounds per square inch gauge
PLC	programmable logic controller
PO_4	phosphate
POU	point-of-use
PVC	polyvinyl chloride
QA	quality assurance
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
RPD	relative percent difference
RO	reverse osmosis
Sb	antimony
SDWA	Safe Drinking Water Act
SiO_2	silica
SMCL	secondary maximum contaminant level
SO_4	sulfate
STS	Severn Trent Services
TDS	total dissolved solids
THM	trihalomethanes
TOC	total organic carbon
TSS	total suspended solids
UPS	uninterruptible power supply
V	vanadium

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The authors wish to extend their appreciation to United Water Systems in the Town of Arnaudville, LA for its willingness to participate in this arsenic removal demonstration project. United Water Systems provided manpower to collect samples from the treatment and distribution systems during the performance evaluation study. United Water Systems also assisted in several onsite special studies.

1.0 INTRODUCTION

1.1 Background

The Safe Drinking Water Act (SDWA) mandates that the U.S. Environmental Protection Agency (EPA) identify and regulate drinking water contaminants that may have adverse human health effects and that are known or anticipated to occur in public water supply systems. In 1975 under the SDWA, EPA established a maximum contaminant level (MCL) for arsenic (As) at 0.05 mg/L. Amended in 1996, the SDWA required that EPA develop an arsenic research strategy and publish a proposal to revise the arsenic MCL by January 2000. On January 18, 2001, EPA finalized the arsenic MCL at 0.01 mg/L (EPA, 2001). In order to clarify the implementation of the original rule, EPA revised the rule text on March 25, 2003, to express the MCL as 0.010 mg/L (10 μg/L) (EPA, 2003). The final rule required all community and non-transient, non-community water systems to comply with the new standard by January 23, 2006.

In October 2001, EPA announced an initiative for additional research and development of cost-effective technologies to help small community water systems (<10,000 customers) meet the new arsenic standard and to provide technical assistance to operators of small systems in order to reduce compliance costs. As part of this Arsenic Rule Implementation Research Program, EPA's Office of Research and Development (ORD) proposed a project to conduct a series of full-scale, on-site demonstrations of arsenic removal technologies, process modifications, and engineering approaches applicable to small systems. Shortly thereafter, an announcement was published in the *Federal Register* requesting water utilities interested in participating in Round 1 of this EPA-sponsored demonstration program to provide information on their water systems. In June 2002, EPA selected 17 out of 115 sites to host the demonstration studies.

In September 2002, EPA solicited proposals from engineering firms and vendors for cost-effective arsenic removal treatment technologies for the 17 host sites. EPA received 70 technical proposals for the 17 host sites, with each site receiving one to six proposals. In April 2003, an independent technical panel reviewed the proposals and provided its recommendations to EPA on the technologies that it determined were acceptable for the demonstration at each site. Because of funding limitations and other technical reasons, only 12 of the 17 sites were selected for the demonstration project. Using the information provided by the review panel, EPA, in cooperation with the host sites and the drinking water programs of the respective states, selected one technical proposal for each site.

In 2003, EPA initiated Round 2 arsenic technology demonstration projects that were partially funded with Congressional add-on funding to the EPA budget. In June 2003, EPA selected 32 potential demonstration sites, and the United Water Systems' facility in Arnaudville, LA was one of those selected.

In September 2003, EPA again solicited proposals from engineering firms and vendors for arsenic removal technologies. EPA received 148 technical proposals for the 32 host sites, with each site receiving from two to eight proposals. In April 2004, another technical panel was convened by EPA to review the proposals and provide recommendations to EPA with the number of proposals per site ranging from none (for two sites) to a maximum of four. The final selection of the treatment technology at the sites that received at least one proposal was made, again, through a joint effort by EPA, the state regulators, and the host site. Since then, four sites have withdrawn from the demonstration program, reducing the number of sites to 28. Kinetico's Macrolite® arsenic removal technology was selected for demonstration at the Arnaudville facility.

As of May 2011, all 40 systems were operational and the performance evaluation of 39 systems was completed.

1.2 Treatment Technologies for Arsenic Removal

The technologies selected for the Round 1 and Round 2 demonstration host sites included 25 adsorptive media (AM) systems (the Oregon Institute of Technology [OIT] site has three AM systems), 13 coagulation/filtration (C/F) systems, two ion exchange (IX) systems, 17 point-of-use (POU) units (including nine under-the-sink reverse osmosis [RO] units at the Sunset Ranch Development site and eight POU-AM units at the OIT site), and one system modification. Table 1-1 summarizes the locations, technologies, vendors, system flowrates, and key source water quality parameters (including As, iron [Fe], and pH) at the 40 demonstration sites. An overview of the technology selection and system design for the 12 Round 1 demonstration sites and the associated capital cost is provided in two EPA reports (Wang et al., 2004; Chen et al., 2004), which are posted on the EPA Web site at http://www.epa.gov/ORD/NRMRL/wswrd/dw/arsenic/index.html.

1.3 Project Objectives

The objective of the arsenic demonstration program was to conduct full-scale arsenic treatment technology demonstration studies on the removal of arsenic from drinking water supplies. The specific objectives were to:

- Evaluate the performance of the arsenic removal technologies for use on small systems.
- Determine the required system operation and maintenance (O&M) and operator skill levels.
- Characterize process residuals produced by the technologies.
- Determine the capital and O&M cost of the technologies.

This report summarizes the performance of the Kinetico system at Arnaudville, LA from July 17, 2006, through September 16, 2010. The types of data collected include system operation, water quality (both across the treatment train and in the distribution system), residuals, and capital and preliminary O&M cost.

Table 1-1. Summary of Arsenic Removal Demonstration Sites

Demonstration Location	Site Name	Technology (Media)	Vendor	Design Flowrate (gpm)	Source Water Quality		
					As (µg/L)	Fe (µg/L)	pH (S.U.)
Northeast/Ohio							
Wales, ME	Springbrook Mobile Home Park	AM (A/I Complex)	ATS	14	38[a]	<25	8.6
Bow, NH	White Rock Water Company	AM (G2)	ADI	70[b]	39	<25	7.7
Goffstown, NH	Orchard Highlands Subdivision	AM (E33)	AdEdge	10	33	<25	6.9
Rollinsford, NH	Rollinsford Water and Sewer District	AM (E33)	AdEdge	100	36[a]	46	8.2
Dummerston, VT	Charette Mobile Home Park	AM (A/I Complex)	ATS	22	30	<25	7.9
Felton, DE	Town of Felton	C/F (Macrolite)	Kinetico	375	30[a]	48	8.2
Stevensville, MD	Queen Anne's County	AM (E33)	STS	300	19[a]	270[c]	7.3
Houghton, NY[d]	Town of Caneadea	C/F (Macrolite)	Kinetico	550	27[a]	1,806[c]	7.6
Buckeye Lake, OH	Buckeye Lake Head Start Building	AM (ARM 200)	Kinetico	10	15[a]	1,312[c]	7.6
Springfield, OH	Chateau Estates Mobile Home Park	AM (E33)	AdEdge	250[e]	25[a]	1,615[c]	7.3
Great Lakes/Interior Plains							
Brown City, MI	City of Brown City	AM (E33)	STS	640	14[a]	127[c]	7.3
Pentwater, MI	Village of Pentwater	C/F (Macrolite)	Kinetico	400	13[a]	466[c]	6.9
Sandusky, MI	City of Sandusky	C/F (Aeralater)	Siemens	340[e]	16[a]	1,387[c]	6.9
Delavan, WI	Vintage on the Ponds	C/F (Macrolite)	Kinetico	40	20[a]	1,499[c]	7.5
Greenville, WI	Town of Greenville	C/F (Macrolite)	Kinetico	375	17	7827[c]	7.3
Climax, MN	City of Climax	C/F (Macrolite)	Kinetico	140	39[a]	546[c]	7.4
Sabin, MN	City of Sabin	C/F (Macrolite)	Kinetico	250	34	1,470[c]	7.3
Sauk Centre, MN	Big Sauk Lake Mobile Home Park	C/F (Macrolite)	Kinetico	20	25[a]	3,078[c]	7.1
Stewart, MN	City of Stewart	C/F&AM (E33)	AdEdge	250	42[a]	1,344[c]	7.7
Lidgerwood, ND	City of Lidgerwood	Process Modification	Kinetico	250	146[a]	1,325[c]	7.2
Midwest/Southwest							
Arnaudville, LA	United Water Systems	C/F (Macrolite)	Kinetico	770[e]	35[a]	2,068[c]	7.0
Alvin, TX	Oak Manor Municipal Utility District	AM (E33)	STS	150	19[a]	95	7.8
Bruni, TX	Webb Consolidated Independent School District	AM (E33)	AdEdge	40	56[a]	<25	8.0
Wellman, TX	City of Wellman	AM (E33)	AdEdge	100	45	<25	7.7
Anthony, NM	Desert Sands Mutual Domestic Water Consumers Association	AM (E33)	STS	320	23[a]	39	7.7
Nambe Pueblo, NM	Nambe Pueblo Tribe	AM (E33)	AdEdge	145	33	<25	8.5
Taos, NM	Town of Taos	AM (E33)	STS	450	14	59	9.5
Rimrock, AZ	Arizona Water Company	AM (E33)	AdEdge	90[b]	50	170	7.2
Tohono O'odham Nation, AZ	Tohono O'odham Utility Authority	AM (E33)	AdEdge	50	32	<25	8.2
Valley Vista, AZ	Arizona Water Company	AM (AAFS50/ARM 200)	Kinetico	37	41	<25	7.8

Table 1-1. Summary of Arsenic Removal Demonstration Sites (Continued)

Demonstration Location	Site Name	Technology (Media)	Vendor	Design Flowrate (gpm)	Source Water Quality		
					As (µg/L)	Fe (µg/L)	pH (S.U.)
Far West							
Three Forks, MT	City of Three Forks	C/F (Macrolite)	Kinetico	250	64	<25	7.5
Fruitland, ID	City of Fruitland	IX (A300E)	Kinetico	250	44	<25	7.4
Homedale, ID	Sunset Ranch Development	POU RO[f]	Kinetico	75 gpd	52	134	7.5
Okanogan, WA	City of Okanogan	C/F (Electromedia-I)	Filtronics	750	18	69[c]	8.0
Klamath Falls, OR	Oregon Institute of Technology	POE AM (Adsorbsia/ARM 200/ArsenX^{np}) And POU AM (ARM 200)[g]	Kinetico	60/60/30	33	<25	7.9
Vale, OR	City of Vale	IX (Arsenex II)	Kinetico	525	17	<25	7.5
Reno, NV	South Truckee Meadows General Improvement District	AM (GFH/Kemiron)	Siemens	350	39	<25	7.4
Susanville, CA	Richmond School District	AM (A/I Complex)	ATS	12	37[a]	125	7.5
Lake Isabella, CA	Upper Bodfish Well CH2-A	AM (HIX)	VEETech	50	35	125	7.5
Tehachapi, CA	Golden Hills Community Service District	AM (Isolux)	MEI	150	15	<25	6.9

AM = adsorptive media; C/F = coagulation/filtration; GFH = granular ferric hydroxide; HIX = hybrid ion exchanger; IX = ion exchange; RO = reverse osmosis
ATS = Aquatic Treatment Systems; MEI = Magnesium Elektron, Inc.; STS = Severn Trent Services
(a) Arsenic existing mostly as As(III).
(b) Design flowrate reduced by 50% after system was switched from parallel to serial configuration.
(c) Iron existing mostly as Fe(II).
(d) Selected originally to replace Village of Lyman, NE site, which withdrew from program in June 2006; withdrew from program in 2007 and replace with a home system in Lewisburg, OH.
(e) Facilities upgraded Springfield, OH system from 150 to 250 gpm, Sandusky, MI system from 210 to 340 gpm, and Arnaudville, LA system from 385 to 770 gpm.
(f) Including nine residential units.
(g) Including eight under-the-sink units.

2.0 SUMMARY AND CONCLUSIONS

Based on the information collected from operation of Kinetico's FM-286-AS pressure filtration system using Macrolite® media at United Water Systems' facility in Arnaudville, LA from July 17, 2006, through September 16, 2010, the following summary and conclusions are provided relating to the overall objectives of the treatment technology demonstration study.

Performance of the arsenic removal technology for use on small systems:

- $KMnO_4$ was effective in oxidizing soluble As(III) to soluble As(V) and soluble Fe(II) to iron solids. Chlorine also was effective in oxidizing soluble As(III) and soluble Fe(II) even with the presence of 1.9 mg/L of ammonia (as N) (on average).
- Unintentional aeration in the aeralater caused extensive biofouling in filter beds. An acid and a caustic wash using 10% HCl and 10% NaOH can restore the filter media. Biological activities, including nitrification, can be controlled by minimizing aeration.
- Aeration in the aeralater apparently caused some soluble iron to precipitate, rendering it ineffective in removing soluble As(V) via adsorption and/or co-precipitation. As a consequence, elevated soluble As(V) levels (close to or over 10 μg/L) were measured in the filter effluent during most of the 4-year study period, regardless of the choice of oxidants.
- Aeration can be eliminated by bypassing the aeralater. Without oxygen, soluble As(V) can be reduced to <6 μg/L based on results of a series of jar tests.
- The effect of supplemental iron addition on arsenic removal was inconclusive, due, in part, to operational issues, such as the use of an oversized pump and a corroding/dissolving impeller/mixer. The use of supplemental iron added extra loading to the filters, thus requiring more frequent backwash.
- Backwash can restore the filter media, but useful filter run lengths were short, averaging <4 hr (at an average filtration rate of 4.4 gpm/ft^2). The backwash frequency went from once to twice a day a few months into the study, to as many as eight times a day after the media was fouled, to as many as 16 times a day when supplemental iron was added.

Required system O&M and operator skill levels:

- The daily demand on the operator was short, averaging 30 min for routine O&M. However, the operator spent a significant amount of time assisting in troubleshooting system operational issues (such as biofouling of filter media and corrosion/dissolution of mixing equipment) and repairing the system (such as pipe breaks).

Characteristics of residuals produced by the technology:

- The amount of wastewater generated was equivalent to 5.5% of the water production, which is much higher than that at other Macrolite® pressure filtration sites.
- Approximately 4.9 lb of solids was produced during each backwash event, including 1.8 lb of iron, 0.08 lb of manganese, and 0.01 lb of arsenic.

Capital and O&M cost of the technology:

- The capital investment for the system was $427,407, including $281,048 for equipment, $50,770 for site engineering, and $95,589 for installation, shakedown, and startup.
- The unit capital cost was $555/gpm (or $0.38/gpd) based on a 770-gpm design flowrate. This calculation does not reflect the building cost as it was funded by United Water Systems.
- The O&M cost was $0.07/1,000 gal including incremental cost for $KMnO_4$, electricity, and labor.

3.0 MATERIALS AND METHODS

3.1 General Project Approach

Following the predemonstration activities summarized in Table 3-1, the performance evaluation study of the Kinetico treatment system began on July 17, 2006, and ended on September 16, 2010. Table 3-2 summarizes the types of data collected and considered as part of the technology evaluation process. The overall system performance was based on its ability to consistently remove arsenic to below the target MCL of 10 μg/L through the collection of water samples across the treatment train. The reliability of the system was evaluated by tracking the unscheduled system downtime and frequency and extent of repair and replacement. The unscheduled downtime and repair information were recorded by the plant operator on a Repair and Maintenance Log Sheet.

The O&M and operator skill requirements were assessed through quantitative data and qualitative considerations, including the need for pre- and/or post-treatment, level of system automation, extent of preventative maintenance activities, frequency of chemical and/or media handling and inventory, and general knowledge needed for relevant chemical processes and related health and safety practices. The staffing requirements for the system operation were recorded on an Operator Labor Hour Log Sheet.

The quantity of aqueous and solid residuals generated was estimated by tracking the volume of backwash water produced during each backwash cycle. Backwash wastewater was sampled and analyzed for chemical characteristics.

The cost of the system was evaluated based on the capital cost per gal/min (gpm) (or gal/day [gpd]) of design capacity and the O&M cost per 1,000 gal of water treated. This task required tracking the capital cost for equipment, engineering, and installation, as well as the O&M cost for media replacement and disposal, chemical supply, electricity usage, and labor.

Table 3-1. Predemonstration Study Activities and Completion Dates

Activity	Date
Introductory Meeting Held	November 3, 2004
Project Planning Meeting Held	March 21, 2005
Final Letter of Understanding Issued	April 8, 2005
Request for Quotation Issued to Vendor	April 13, 2005
Vendor Quotation Received b Battelle	May 3, 2005
Purchase Order Completed and Signed	May 23, 2005
Engineering Plan Submitted to LADHH/OPH	August 19, 2005
System Permit Issued by LADHH/OPH	September 16, 2005
Pre-construction Meeting Held	February 27, 2006
Notice to Proceed Issued to Building Contractor	March 6, 2006
Treatment Equipment Arrived	April 10, 2006
System Installation Complete	June 7, 2006
System Start-up and Shakedown Completed	June 23, 2006
Performance Evaluation Begun	July 17, 2006
Final Study Plan Issued	August 7, 2006
Request for $FeCl_3$ Addition Submitted to LADHH/OPH	June 21, 2007
Request Granted by LADHH/OPH	August 8, 2007

LADHH = Louisiana Department of Health and Hospitals; OPH = Office of Public Health

Table 3-2. Evaluation Objectives and Supporting Data Collection Activities

Evaluation Objective	Data Collection
Performance	-Ability to consistently meet 10 μg/L of arsenic in treated water
Reliability	-Unscheduled system downtime -Frequency and extent of repairs including a description of problems, materials and supplies needed, and associated labor and cost
System O&M and Operator Skill Requirements	-Pre- and post-treatment requirements -Level of automation for system operation and data collection -Staffing requirements including number of operators and laborers -Task analysis of preventative maintenance including number, frequency, and complexity of tasks -Chemical handling and inventory requirements -General knowledge needed for relevant chemical processes and health and safety practices
Residual Management	-Quantity and characteristics of aqueous and solid residuals generated by system operation
System Cost	-Capital cost for equipment, engineering, and installation -O&M cost for chemical usage, electricity consumption, and labor

3.2 System O&M and Cost Data Collection

The plant operator performed daily, weekly, and/or monthly system O&M and data collection upon Battelle's requests. On a daily basis, the plant operator recorded system operational data, such as pressure, flowrate, totalizer, and hour meter readings on a Daily System Operation Log Sheet, checked potassium permanganate ($KMnO_4$), ferric chloride ($FeCl_3$), and/or sodium hypochlorite (NaOCl) levels, and conducted visual inspections to ensure normal system operations. If any problem occurred, the plant operator contacted the Battelle Study Lead, who determined if the vendor should be contacted for troubleshooting. The plant operator recorded all relevant information, including the problem encountered, course of actions taken, materials and supplies used, and associated cost and labor incurred, on a Repair and Maintenance Log Sheet. To the extent possible, the plant operator measured several water quality parameters onsite, including temperature, pH, dissolved oxygen (DO), oxidation-reduction potential (ORP), and residual chlorine, and recorded them on an Onsite Water Quality Parameters Log Sheet. Monthly backwash data also were recorded on a Backwash Log Sheet.

The capital cost for the arsenic removal system consisted of the cost for equipment, site engineering, and system installation. The O&M cost consisted of the cost for chemical usage, electricity consumption, and labor. Consumption of $KMnO_4$, $FeCl_3$, and/or NaOCl was tracked on the Daily System Operation Log Sheet. Electricity consumption was determined from utility bills. Labor for various activities, such as routine system O&M, troubleshooting and repairs, and demonstration-related work, was tracked using an Operator Labor Hour Log Sheet. The routine system O&M included activities such as completing field logs, replenishing the chemical solutions, ordering supplies, performing system inspections, and others as recommended by the vendor. The labor for demonstration-related work, including activities such as performing field measurements, collecting and shipping samples, and communicating with the Battelle Study Lead and the vendor, was recorded, but not used for the cost analysis.

3.3 Sample Collection Procedures and Schedules

To evaluate system performance, water samples were collected at the wellhead, across the treatment plant, during Macrolite® filter backwash, from the distribution system and during one hydrant flush event. Table 3-3 presents the sampling schedule and analytes measured during each sampling event. In addition,

Table 3-3. Sampling Schedule and Analyses

Sample Type	Sample Locations[a]	No. of Samples	Frequency	Analytes	Collection Date
Source Water	IN	1	Once	Onsite: pH, temperature, DO, and ORP Offsite: As(III), As(V), As (total and soluble), Fe (total and soluble), Mn (total and soluble), U (total and soluble), V (total and soluble), Na, Ca, Mg, F, Cl, NO_2, NO_3, NH_3, SO_4, SiO_2, PO_4, TDS, TOC, turbidity, and alkalinity	11/03/04
Treatment Plant Water (Regular)	IN, AC, TA, and TB	4	Varying	Onsite: pH, temperature, DO, ORP, and/or total Cl_2[b] Offsite: As (total), Fe (total), Mn (total), SiO_2, P, turbidity, and alkalinity	See Appendix B
Treatment Plant Water (Speciation)	IN, AC, and TT	3	Varying	Onsite: pH, temperature, DO, ORP, and/or total Cl_2[c] Offsite: As(III), As(V), As (total and soluble), Fe (total and soluble), Mn (total and soluble), Ca, Mg, F, NO_3, NH_3, SO_4, SiO_2, P, TOC, turbidity, and/or alkalinity	See Appendix B
Backwash Wastewater	BW	2	Varying	pH, TSS, TDS, As (total and soluble), Fe (total and soluble), Mn (total and soluble)	See Table 4-14
Residual Solids	Backwash Solids from Each Tank	2	Once	Total Ag, As, Ba, Cd, Cr, Hg, Pb, and Se	Not performed
Distribution Water	Three LCR Residences	3	Monthly[d]	pH, alkalinity, As (total), Fe (total), Mn (total), Pb, and Cu	See Table 4-15

(a) Abbreviations corresponding to sample locations in Figure 3-1, i.e., IN = at wellhead; AC = after contact tank; TA = after Vessel A; TB = after Vessel B; TT = after Vessels A and B combined; BW = at backwash discharge line; SS = sludge sampling location.
(b) At AC, TA, and/or TB only.
(c) At AC and/or TT only.
(d) Discontinued on 04/03/07.

Figure 3-1 presents a flow diagram of the treatment system along with the analytes and schedule for each sampling location. Specific sampling requirements for analytical methods, sample volumes, containers, preservation, and holding times are presented in Table 4-1 of the EPA-endorsed Quality Assurance Project Plan (QAPP) (Battelle, 2004). The procedure for arsenic speciation is described in Appendix A of the QAPP.

3.3.1 Source Water. During the initial site visit on November 3, 2004, one set of source water samples from Wells 1 and 2 was collected and speciated using arsenic speciation kits (Section 3.4.1). Before sampling, sample taps were flushed for several minutes; special care was taken to avoid agitation, which might cause unwanted oxidation. The samples were analyzed for analytes listed in Table 3-3. Arsenic speciation kits and containers for water quality samples were provided by Battelle and American Analytical Laboratories (AAL), respectively. Sample containers for total organic carbon (TOC) were provided by TCCI Laboratories, Inc.

3.3.2 Treatment Plant Water. The Battelle Study Plan (Battelle, 2006) called for the collection of weekly treatment plant water samples on a four-week cycle. For the first week of each four-week cycle, samples were collected at the wellhead (IN), after the contact tank (AC), and after Vessels A and B combined (TT), speciated onsite, and analyzed for the analytes listed under "Treatment Plant Speciation Sampling" in Table 3-3. For the next three weeks, samples were collected at IN, AC, after Vessel A (TA), and after Vessel B (TB) and analyzed for the analytes listed under "Treatment Plant Regular Sampling" in Table 3-3.

Due to various operational issues encountered during the performance evaluation study, speciation and regular sampling were performed as scheduled only between August 10, 2006, through April 30, 2007 (except for five sampling events on November 28, 2006, December 19, 2006, January 1, 2007, February 21, 2007, and April 30, 2007, when biweekly samples were collected due to holidays and other logistic issues). After April 30, 2007, sampling discontinued and resumed a number of times for the following reasons:

- Poor system performance led the project team to believe that supplemental iron addition was necessary to enhance soluble arsenic removal by the treatment system. Sampling discontinued after April 30, 2007, to await the installation of an iron addition system. Sampling resumed on January 23, 2008, with onsite speciation for arsenic, iron, and manganese only. Five additional sampling events followed on January 28, March 11, March 19, March 24, and April 17, 2008. For the March 19 and March 24 samples, total phosphorus also was analyzed.
- Irregularities on iron dosing occurred after implementation of iron addition. Sampling discontinued after April 17, 2008 to await results of a run length study by the operator. Despite the fact that irregular iron dosing continued, sampling with onsite speciation for arsenic, iron and manganese resumed on November 18, 2008, and lasted until March 30, 2009. During this period, seven sampling events took place, with one each in November and December 2008, two in January 2009, and three in March 2009.
- Upon conferring with the operator, it was determined that aeration in the aeralater in fact continued. To minimize aeration, the operator agreed to remove aluminum trays in the aeralater and cut the standpipe 4 ft below the high-level sensor in the aeralater. Meanwhile, supplemental iron addition was suspended. Speciation sampling as noted in Table 3-3 resumed on August 18, 2009, and lasted until August 5, 2010. A total of 19 sampling events took place, with one in August 2009, four each in September and October 2009, three in November 2009, one in December 2009, three in January 2010, two in February 2010, and one in August 2010.

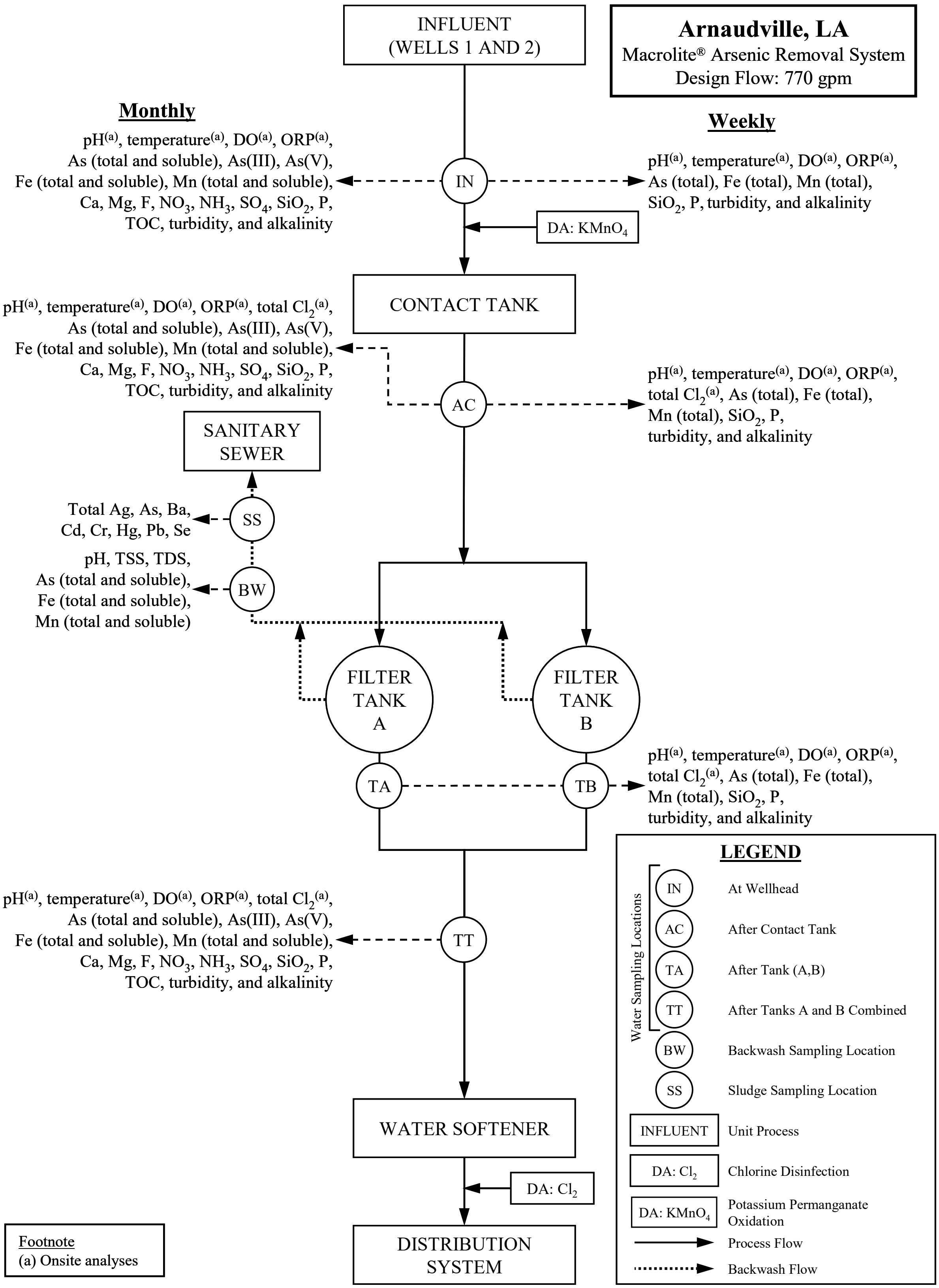


Figure 3-1. Process Flow Diagram and Sampling Schedule and Locations

3.3.3 Backwash Wastewater. Monthly backwash wastewater samples were collected six times by the plant operator between September 19, 2006, and March 25, 2007. Backwash wastewater samples were collected by directing a portion of backwash wastewater at approximately 1 gpm to a clean, 32-gal container over the duration of backwash for each vessel. This sidestream was produced via plastic tubing connecting to a tap on the backwash wastewater discharge line. After the content in the container was thoroughly mixed, composite samples were collected and/or filtered onsite with 0.45-µm disc filters. Analytes for the backwash wastewater samples are listed in Table 3-3.

3.3.4 Distribution System Water. Water samples were collected from the distribution system to determine the impact of the arsenic treatment system on the water chemistry in the distribution system, specifically, arsenic, lead, and copper levels. Prior to system startup from August 2005 to January 2006, four monthly baseline distribution system water samples were collected from three residences within the town's historic Lead and Copper Rule (LCR) sampling network. Following system startup, distribution system water sampling began in September 2006 and ended in April 2007 on a monthly basis at the same three locations.

Homeowners collected samples following an instruction sheet developed according to the *Lead and Copper Monitoring and Reporting Guidance for Public Water Systems* (EPA, 2002). The dates and times of last water usage before sampling and of actual sample collection were recorded for determination of the stagnation time. Except for one on November 30, 2005, all samples were collected from a cold-water faucet that had not been used for at least 6 hr to ensure that stagnant water was sampled.

3.3.5 Residual Solids. Residual solids produced consisted of only backwash wastewater solids. Per the Battelle Study Plan, solid samples would be collected on two occasions after solids in backwash wastewater had settled (in a 32-gal container) and supernatant had been carefully decanted. A portion of each of the solids/water mixtures would then be air-dried for metals analyses. Residual solid sampling was planned but never actually performed during the performance evaluation study.

3.4 Special Studies

Due to on-going problems with system performance, several special studies were conducted to examine possible causes and solutions to improve performance. The studies performed included several filter run length studies and a series of jar tests.

3.4.1 Filter Run Length Studies. Filter run length studies were conducted by collecting a series of effluent samples from one or both pressure filters to determine useful run lengths between two consecutive backwash events. Filtered (with 0.45 µm disc filters) and unfiltered samples collected at predetermined time intervals were analyzed for total and soluble metals and/or some or all of the other analytes listed in Table 3-4.

Table 3-4. Test Matrix for Run Length Studies

Sample Location	Filter Run Length (hr)	pH	Temperature	DO	ORP	Total Chlorine	Total As, Fe, and Mn	Soluble As, Fe, and Mn	As(III)	As(V)	Ammonia	Silica	TOC
IN	0	×	×	×	×	×	×	×	×	×	×	×	×
AC	0	×	×	×	×	×	×	×	×	×	×	×	×
TA/TB	X	×	×	×	×	×	×	×					

3.4.2 Jar Tests. A series of jar tests were conducted from January 18 to 22, 2010, to determine (1) the most effective oxidant, (2) a proper dosage, and (3) arsenic and iron removal using select doses of oxidants. During system startup and until March 29, 2007, $KMnO_4$ had been used for oxidizing arsenic, iron, and manganese. Although effective, concerns about biofouling of the filter media prompted the use of chlorine. Residual chlorine levels in system effluent (or influent to the softening unit) had to be kept below 1.0 mg/L (as Cl_2) because the synthetic zeolite in the softening unit might be sensitive to chlorine.

The first part of the jar tests used three doses of NaOCl and three doses of $KMnO_4$ to gain information about an optimal dosage for each oxidant. One dose of NaOCl and all three doses of $KMnO_4$ were then used to examine their effectiveness in treating arsenic, iron, and manganese in source water. Due to the presence of ammonia in source water, NaOCl would react with ammonia to form chloramines, which would reduce oxidation kinetics. Breakpoint chlorination could not be used because it would result in unacceptably high chemical use. When using $KMnO_4$, colloidal MnO_2 particles might form due to the presence of TOC in source water; colloidal particles might not be removed by the filter media (Pellitier, 2010). Additional $KMnO_4$ might be added to "offset" effects exerted by TOC, based on observations made during studies at arsenic demonstration sites such as Sauk Centre, MN (Shiao et al., 2009) and Waynesville, IL (Chen et al., 2011; 2010c). Specific procedures developed for the jar tests are described below.

3.4.2.1 Raw Water Collection. Raw water was collected from the wellhead sample tap in a manner that minimized oxidation of source water and preserved its in-well characteristics throughout its use. After turning off the gas chlorine addition valve and thoroughly flushing the sample tap for at least 15 min, raw water was filled into a 2.5-gal partially opaque jug at a low flowrate from the bottom using Tygon® tubing. Once the jug was filled, it was allowed to overflow to remove layers of potentially oxidized water. Thus, potential oxidation of raw water was diffusion-limited to a small layer near the air/water interface within the jug and relatively far away from the sample tap located near the bottom of the jug. The last 1 gal of water from the jug was not used for the studies. pH, DO, ORP, and temperature were measured directly from the bottom of the overflowing jug.

In addition to the sample tap, the jug also was equipped with a small hole on its top to provide pressure during sampling. When the sampling tap was not open, the hole was covered with a piece of tape to reduce air intrusion. The water just below the interface was periodically observed during the experiment for signs of oxidation (light attenuation and scattering caused by the precipitation of oxidized metals); however, this proved difficult, since the sample jug was partially opaque. No signs of significant oxidation were noted during the study, although a slight yellow hue was noted in the jug approximately 60 min after collection. Water with an appreciably noticeable yellow hue was disposed of and fresh raw water was used in its place.

3.4.2.2 Jar Test Procedures. The jar tests were carried out using raw water collected as described in Section 3.4.2.1. 1-L amber glass jars were spiked with appropriate amounts of an oxidant and then filled with raw water from the 2.5-gal jug. The actual oxidant dose was determined by spiking 1-L amber jars filled with deionized (DI) water and measuring respective oxidant concentrations. Care was taken to minimize agitation when filling the jars. The jars were mixed by inverting them with the aid of stainless steel weights added prior to raw water addition.

To determine an appropriate contact time, a simple calculation was made using the contact tank volume and average flowrate to the contact tank; the ratio of these provided the hydraulic detention time within the contact tank. The contact time within the tank was found to be about 20 min; therefore, a 20-min contact time was used for all jar tests.

After the 20-min contact time, contents in some 1-L jars were measured for residual chlorine or $KMnO_4$ to determine optimal doses (see Table 3-5). For arsenic and iron removal, an extended suite of analytes, including metal speciation, ammonia, TOC, pH, temperature, DO, and ORP also were analyzed (see Table 3-6). The order of the sampling/measurements (as presented herein) was important to ensure that minimal oxygen dissolution occurred while the 1-L jars were open to the atmosphere. All samples were taken with a sterile 25-mL pipette from the bottom of the jars.

Table 3-5. Test Matrix for Determining Optimal Oxidant Doses

Oxidant	Oxidant Dose (as mg/L Cl_2 or $KMnO_4$)	Reaction Time (min)	Total Chlorine	$KMnO_4$
NaOCl	0.0	20	×	
	2.2	20	×	
	4.2	20	×	
	7.1	20	×	
$KMnO_4$	0.0	20		×
	1.9	20		×
	4.2	20		×
	6.6	20		×

Table 3-6. Test Matrix for Arsenic and Iron Removal

Oxidant	Oxidant Dose (as mg/L Cl_2 or $KMnO_4$)	Reaction Time (min)	pH	Temperature	DO	ORP	Total Chlorine	$KMnO_4$	Total As, Fe, and Mn	Soluble As, Fe, and Mn	As(III)	As(V)	Ammonia	TOC
None	0	-	×	×	×	×	×	×	×	×	×	×	×	×
NaOCl	2.2	20	×	×	×	×	×	-	×	×	×	×	×	×
$KMnO_4$	1.9	20	×	×	×	×	-	×	×	×	×	×	×	×
	4.2	20	×	×	×	×	-	×	×	×	×	×	×	×
	6.6	20	×	×	×	×	-	×	×	×	×	×	×	×

3.4.2.3 Aeralater Bypass. A valve that diverted the flow to the aeralater was closed so that well water, after chlorination, could flow directly into the Macrolite® pressure filters via a 4-in pipe. With the diversion valve closed, samples collected from the AC location represented water that had not been aerated. One sample each was collected both before and after aeralater bypass. The samples were then speciated for total and soluble arsenic, iron, and manganese, soluble As(III), and soluble As(V), and analyzed for NH_3, pH, temperature, ORP, DO, and total chlorine.

3.5 Sampling Logistics

3.5.1 Preparation of Arsenic Speciation Kits. The arsenic field speciation method uses an anion exchange resin column to separate the soluble arsenic species, As(V) and As(III) (Edwards et al., 1998). Resin columns were prepared in batches at Battelle laboratories according to the procedures detailed in Appendix A of the QAPP (Battelle, 2004).

3.5.2 Preparation of Sample Coolers. For each sampling event, a sample cooler was prepared with the appropriate number and type of sample bottles, disc filters, and/or speciation kits. All sample bottles were new and contained appropriate preservatives. Each sample bottle was affixed with a pre-printed, colored-coded label consisting of the sample identification (ID), date and time of sample collection, collector's name, site location, sample destination, analysis required, and preservative. The sample ID consisted of a two-letter code for the demonstration site, the sampling date, a two-letter code for a specific sampling location, and a one-letter code designating the arsenic speciation bottle (if necessary). The sampling locations at the treatment plant were color-coded for easy identification. The labeled bottles were separated by sampling location, placed in zip-lock bags, and packed into the cooler.

In addition, all sampling- and shipping-related materials, such as disposable gloves, sampling instructions, chain-of-custody forms, prepaid/addressed FedEx air bills, and bubble wrap, were included. The chain-of-custody forms and air bills were complete except for the operator's signature and the sample dates and times. After preparation, the sample cooler was sent to the site via FedEx for the following week's sampling event.

3.5.3 Sample Shipping and Handling. After sample collection, samples for offsite analyses were packed carefully in the original coolers with wet ice and shipped back to Battelle. Upon receipt, the sample custodian verified that all samples indicated on the chain-of-custody forms were included and intact. Sample IDs were checked against the chain-of-custody forms, and the samples were logged into the laboratory sample receipt log. Discrepancies noted by the sample custodian were addressed with the plant operator by the Battelle Study Lead.

Samples for metal analyses were stored at Battelle's inductively coupled plasma-mass spectrometry (ICP-MS) laboratory. Samples for other water quality analyses were packed in separate coolers and picked up by couriers from AAL in Columbus, OH and TCCI Laboratories in New Lexington, OH, which were both under contract with Battelle for this demonstration study. The chain-of-custody forms remained with the samples from the time of preparation through analysis and final disposition. All samples were archived by the appropriate laboratories for the respective duration of the required hold time and disposed of properly thereafter.

3.6 Analytical Procedures

The analytical procedures described in Section 4.0 of the QAPP (Battelle, 2004) were followed by Battelle's ICP-MS laboratory, AAL, and TCCI Laboratories, and Belmont Labs. Laboratory quality assurance/quality control (QA/QC) of all methods followed the prescribed guidelines. Data quality in terms of precision, accuracy, method detection limits (MDLs), and completeness met the criteria established in the QAPP (i.e., relative percent difference [RPD] of 20%, percent recovery of 80 to 120%, and completeness of 80%). The QA data associated with each analyte will be presented and evaluated in a QA/QC Summary Report to be prepared under separate cover upon completion of the Arsenic Demonstration Project.

Field measurements of pH, temperature, DO, and ORP were conducted by the plant operator using a handheld field meter, which was calibrated for pH and DO prior to use following the procedures provided in the user's manual. The ORP probe also was checked for accuracy by measuring the ORP of a standard solution and comparing it to the expected value. The plant operator collected a water sample in a clean, plastic beaker and placed the probe in the beaker until a stable value was obtained. The plant operator also performed free and total chlorine measurements using Hach chlorine test kits following the user's manual.

4.0 RESULTS AND DISCUSSION

4.1 Site Description

4.1.1 Pre-existing Facility. Located at 1004 Twin Oaks Drive in Arnaudville, LA, United Water Systems Treatment System served approximately 1,200 service connections in rural areas of Arnaudville, Cecilia, Breaux Bridge, and Bayou Portage in St. Landry and St. Martin Parishes. The system was supplied by two 10-in production wells, i.e., Wells No. 1 and No. 2, drilled to a depth of approximately 560 ft. Each well was equipped with a 15-horsepower (hp) submersible pump rated for 350 or 375 gpm against a 90-lb/in^2 (psi) head. Prior to the demonstration project, the wells alternated with each well operating approximately four times per day for a total daily operating time of 15 to 23 hr. The typical daily water usage was between 280,000 to 380,000 gpd with an estimated peak daily demand of 400,000 gpd.

The pre-existing treatment system consisted of aeration, prechlorination, sand filtration, softening, post-chlorination, and zinc orthophosphate addition (Figure 4-1). Aeration was performed at the top section of an 11-ft diameter aeralater (Figure 4-2) to oxidize soluble iron. Chlorine addition occurred within the aeralater to achieve further oxidation. The chlorinated water passed through a gravity filter within the aeralater and to a separate pressure filter to remove precipitated iron particles. Seventy percent of the water from the pressure filter was then treated by a synthetic zeolite water softener for hardness removal (Figure 4-3). The other 30% bypassed the softener and was blended with the softened water before post-chlorination and storage onsite in a 127,000-gal storage tank (Figure 4-4). Treated water in the storage tank was transferred to a 10,000-gal hydropneumatic tank (Figure 4-5) before entering the distribution system.

System piping and flow path/control were arranged so that raw water was fed from one of the two wells into a manifold and a 6-in standpipe leading toward the top of the aeralater. The well pumps were

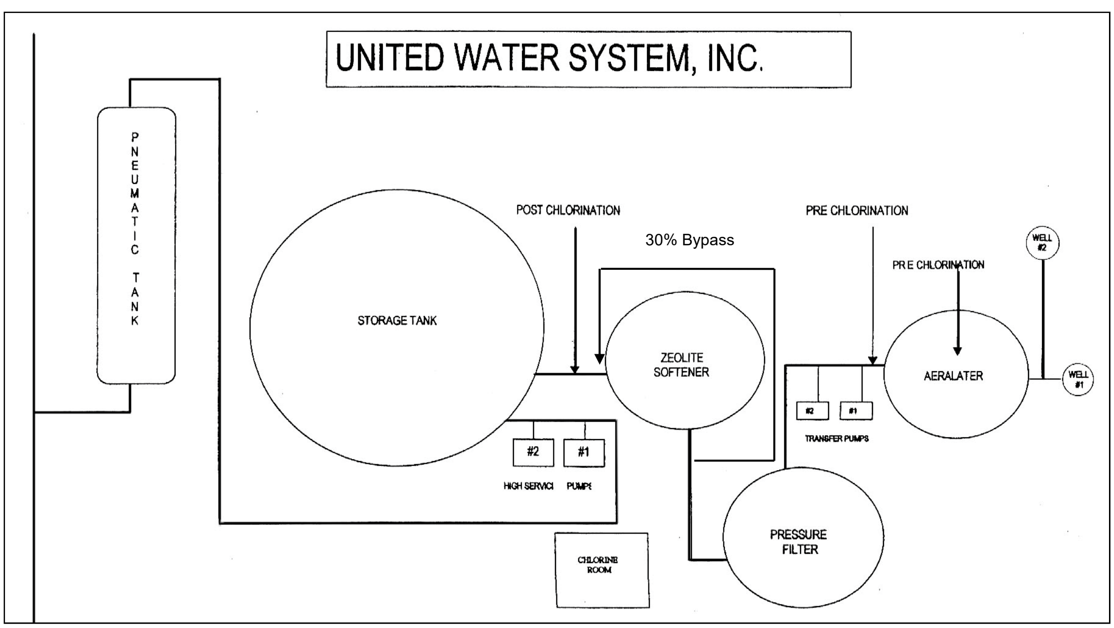


Figure 4-1. Pre-existing Treatment Train

Figure 4-2. Pre-existing Aeralater

Figure 4-3. Pre-existing Water Softener

Figure 4-4. Pre-existing Storage Tank (*center*) with Hydropneumatic Tank at Its Side (*left*)

Figure 4-5. Pre-existing Hydropneumatic Tank

controlled by a set of high- and low-level sensors within the top section of the aeralater. Water discharged from the standpipe splashed downward through a series of aluminum trays where air was forced from a blower to aerate the water. After passing the gravity filter within the aeralater, water was pumped by two transfer pumps (Figure 4-6) to the pressure filter and water softener before entering the 127,000-gal storage tank. The transfer pumps were controlled by a set of high- and low-level sensors in the storage tank. Treated water in the storage tank was transferred by two high service pumps to a 10,000-gal hydropneumatic tank before entering the distribution system. A pair of high- and low-level sensors in the hydropneumatic tank controlled the flow from the storage tank to the hydropneumatic tank.

Figure 4-6. Pre-existing Transfer Pumps

For the arsenic removal technology demonstration, the pre-existing aeralater was used as a contact tank (instead of an aerator and a gravity filtration unit) and two Macrolite® pressure filters were installed to replace the pre-existing pressure filter. Other pre-existing system components and piping and flow path/control arrangements remained mostly unchanged.

4.1.2 Distribution System. The distribution system was a closed looped distribution line supplied via the 127,000-gal storage tank by Wells No. 1 and No. 2. The distribution line was constructed of 2-in to 6-in Schedule 40 and Class 160 polyvinyl chloride (PVC) piping. United Water Systems sampled daily for chlorine residuals, monthly for bacterial analysis, and once every three years at 10 residences under the LCR. The facility also performed regular sampling for volatile organic compounds (VOCs), metals, and pesticides approximately once every three years or as directed by the LADHH/OPH.

4.1.3 Source Water Quality. Source water samples from Wells No. 1 and No. 2 were collected and speciated by Battelle on November 3, 2004. Analytical results from the source-water sampling are presented in Table 4-1 and compared to those taken by the facility, Kinetico, and the Louisiana Department of Health and Hospitals/Office of Public Health (LDHH/OPH).

Table 4-1. Source Water Quality Data

Parameter	Unit	Facility Data			Kinetico Data	Battelle Data		LDHH/OPH Data		
		Well No. 1	Well No. 2	Dist. System	Well	Well No. 1	Well No. 2	Well No. 1	Well No. 2	Dist. System
	Date	-	-	-	-	11/03/04		04/26/99–07/07/03		
pH	S.U.	7.3	7.2	NA	7.0	7.0	7.0	7.1–7.3	7.0	NA
Temperature	°C	NA	NA	NA	NA	21.1	20.7	NA	NA	NA
DO	mg/L	NA	NA	NA	NA	0.4	0.7	NA	NA	NA
ORP	mV	NA	NA	NA	NA	-105	-101	NA	NA	NA
Total Alkalinity[(a)]	mg/L	309	315	NA	312	308	308	298–305	302–313	NA
Hardness[(a)]	mg/L	NA	NA	42	290	316	294	173–243	170–224	NA
Turbidity	NTU	NA	NA	NA	NA	25.0	20.0	0.6–3.2	3.1–7.0	NA
TDS	mg/L	NA	NA	NA	NA	392	336	396–416	354–364	NA
TOC	mg/L	NA	NA	NA	NA	2.1	1.5	NA	NA	NA
Nitrate (as N)	mg/L	NA	NA	NA	NA	<0.04	<0.04	<0.014	<0.014	NA
Nitrite (as N)	mg/L	NA	NA	NA	NA	<0.01	<0.01	NA	NA	NA
Ammonia (as N)	mg/L	NA	NA	NA	NA	1.9	1.8	NA	NA	NA
Chloride	mg/L	42.0	6.0	NA	43.3	37.0	11.0	30.7–53.2	4.2–9.0	NA
Fluoride	mg/L	NA	NA	NA	0.4	<0.1	<0.1	0.1–0.2	0.2	NA
Sulfate	mg/L	0.3	0.6	NA	<4.0	<1.0	<1.0	<0.014	<0.014	NA
Silica (as SiO_2)	mg/L	NA	NA	NA	44.9	41.0	42.4	NA	NA	NA
Orthophosphate	mg/L	NA	NA	NA	0.8	<0.06	<0.06	NA	NA	NA
As (total)	µg/L	18.0	24.0	19.0	22.0	33.6	35.9	17.0–33.0	25.0–37.0	NA
As (soluble)	µg/L	NA	NA	NA	NA	33.1	35.8	NA	NA	NA
As (particulate)	µg/L	NA	NA	NA	NA	0.5	0.1	NA	NA	NA
As(III)	µg/L	NA	NA	NA	NA	32.8	34.6	NA	NA	NA
As(V)	µg/L	NA	NA	NA	NA	0.3	1.2	NA	NA	NA
Fe (total)	µg/L	1,840	1,630	70	2,520	2,136	1,999	2,020–2,530	1,910–2,240	NA
Fe (soluble)	µg/L	NA	NA	NA	NA	2,140	2,004	NA	NA	NA
Mn (total)	µg/L	110	100	NA	140	133	120	120–150	120–140	NA
Mn (soluble)	µg/L	NA	NA	NA	NA	133	125	NA	NA	NA
U (total)	µg/L	NA	NA	NA	NA	<0.1	<0.1	NA	NA	NA
U (soluble)	µg/L	NA	NA	NA	NA	<0.1	<0.1	NA	NA	NA
V (total)	µg/L	NA	NA	NA	NA	1.7	0.5	NA	NA	NA
V (soluble)	µg/L	NA	NA	NA	NA	0.6	0.7	NA	NA	NA
Pb (total)	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	<1–3
Cu (total)	µg/L	NA	NA	NA	NA	NA	NA	<5	<5	<5–1,400
Na (total)	mg/L	27.0	15.0	113.0	33.0	41.7	25.0	3.6–36.9	0.5–23.1	NA
Ca (total)	mg/L	NA	NA	NA	78.5	78.5	73.0	NA	NA	NA
Mg (total)	mg/L	NA	NA	NA	23	29.0	27.1	NA	NA	NA

(a) as $CaCO_3$.
(b) as PO_4.
DO = dissolved oxygen; NA = not analyzed; LDHH/OPH = Louisiana Department of Health and Hospitals/Office of Public Health; ORP = oxidation-reduction potential; TDS = total dissolved solids; TOC = total organic carbon

Arsenic. Total arsenic concentrations in source water ranged from 17.0 to 37.0 µg/L. Based on the November 3, 2004 sampling results, 98% (32.8 out of 33.6 µg/L for Well No. 1) and 96% (34.6 out of 35.9 µg/L for Well No. 2) existed as soluble As(III) with the balance made up of soluble As(V). A negligible amount of particulate arsenic also existed in source water. Thus, the proposed treatment process required the injection of $KMnO_4$ for the oxidation of soluble As(III) to soluble As(V) and subsequent adsorption and co-precipitation of soluble As(V) onto/with iron solids.

Iron. Iron concentrations measured in source water ranged from 1630 to 2530 µg/L, which exceeded the secondary maximum contaminant level (SMCL) of 300 µg/L. Typically, the soluble iron concentration should be at least 20 times the soluble arsenic concentration for effective arsenic removal via adsorption and co-precipitation with iron solids (Sorg, 2002). Based on the data shown in Table 4-1, natural soluble iron levels were approximately 60 times the soluble arsenic levels in source water, indicating that there would be no need to supplement the natural iron levels for effective arsenic removal.

Manganese. Total manganese levels in source water ranged from 100 to 150 µg/L, which exceeded the 50-µg/L SMCL for manganese. Of the total manganese present in source water, all of it was in the soluble form, owing to the reducing nature of the source water.

Ammonia. Ammonia concentrations measured in source water ranged from 1.8 to 1.9 mg/L (as N). Due to the presence of ammonia and TOC in source water, Kinetico proposed the use of $KMnO_4$ to oxidize soluble As(III) to soluble As(V) rather than NaOCl. NaOCl is known to react with ammonia to form chloramines, which is not very effective in oxidizing soluble As(III) (Chen et al., 2009; Ghurye and Clifford, 2001). NaOCl also is known to react with TOC to form disinfection byproducts (DBPs), such as trihalomethanes (THMs) and haloacetic acids (HAA5). However, chloramines most likely will not react with TOC to form DBPs (Bougeard et al, 2010; Amy et al., 1984).

Competing Anions. Silica and phosphate may compete with arsenic for available adsorption sites on iron solids. Silica also may lower the point of zero charge of precipitated iron particles and/or form networks with other adsorbed anions of the same species (Smith and Edwards, 2005; Meng, 2000; Meng, 2002). Typically, silica at levels greater than 40 mg/L and phosphate at levels greater than 1 mg/L may impact arsenic adsorption onto iron particles or iron-based adsorption media. Silica levels in source water were high, ranging from 41.0 mg/l to 44.9 mg/L. Orthophosphate levels in the source water collected by Battelle were less than its MDL of 0.06 mg/L (as PO_4). However, the data collected by Kinetico showed orthophosphate at 0.8 mg/L (as PO_4). Orthophosphate levels were monitored over the course of the demonstration study to determine if they were significant enough to have an effect on the arsenic removal process.

Other Water Quality Parameters. pH values of source water samples ranged between 7.0 and 7.3. DO levels were low at 0.4 to 0.7 mg/L and ORP readings ranged from -101 mV to -105 mV, suggesting reducing conditions for the well water, which explained the metals speciation results. Source water had high alkalinity and hardness, which measured between 298 and 313 mg/L and between 173 and 316 mg/L, respectively. Total dissolved solids (TDS) levels ranged from 336 to 416 mg/L. Fluoride concentrations ranged from <0.1 to 0.4 mg/L, well below the MCL of 4 mg/L. Chloride, nitrate, and nitrite were all below their respective SMCLs. Source water also was sampled by the LDHH/OPH for antimony, barium, beryllium, cadmium, chromium, mercury, nickel, selenium, silver, thallium, and zinc. Concentrations of these metals were all below their respective MCLs or SMCLs, and were typically less than their MDLs.

4.2 Treatment Process Description

The treatment process at Arnaudville, LA consisted of oxidation of soluble As(III) and soluble Fe(II) using $KMnO_4$, adsorption/coprecipitation of soluble As(V) onto/with iron solids, and Macrolite® pressure filtration to remove arsenic-laden particles. The pre-existing aeralater was “emptied” and used as a contact tank in front of the Macrolite® pressure filters. (Because the aeration feature of the aeralater was not completely removed and because of repeated miscommunications between the operator and the project team concerning this fact, the aeralater continued to be used as an aerator during most of the performance evaluation study. As a result, the system failed to consistently remove arsenic to less than the 10-µg/L MCL despite repeated attempts to troubleshoot this during the study period.) The pre-existing pressure filter (120-in × 92-in) was emptied and converted to a softener after the Macrolite® filters.

Macrolite®, a ceramic media manufactured by Kinetico, was approved for use in drinking water applications under NSF International (NSF) Standard 61. The spherical, low density and chemically inert media were designed to allow for filtration rates up to 10 gpm/ft^2. The physical properties of the media are summarized in Table 4-2.

Table 4-2. Properties of 40/60 Mesh Macrolite® Media

Property	Value
Color	Variable
Sphere Size Range (mm)	23–36
Bulk Density (g/mL)	0.86
Specific Gravity	2.05
Collapse Strength (for 30/50 mesh) (psi)	7,000 to 8,000

Figure 4-7 is a schematic of the installed Macrolite® FM-284-AS arsenic removal system. The treatment system consisted of two chemical feed systems for $KMnO_4$ addition at both wellheads, a pre-existing aeralater to provide contact time, two pressure vessels with hub and lateral stainless steel underdrains, and associated instrumentation. The treatment system also was equipped with a central control panel that housed a touch screen operator interface panel (OIP), a programmable logic controller (PLC), a modem, and an uninterruptible power supply (UPS). The control panel was connected to various instruments used to track system performance including inlet and outlet pressure for each filter, system flowrate, and backwash flowrate and turbidity. All plumbing for the system was schedule 80 PVC and the skidded units were pre-plumbed with the necessary isolation valves, check valves, sampling ports, and other features. A 15-hp, 120-gal air compressor was provided with the system for air sparging of the media during the backwash cycle. Table 4-3 specifies the key system design parameters of the treatment system.

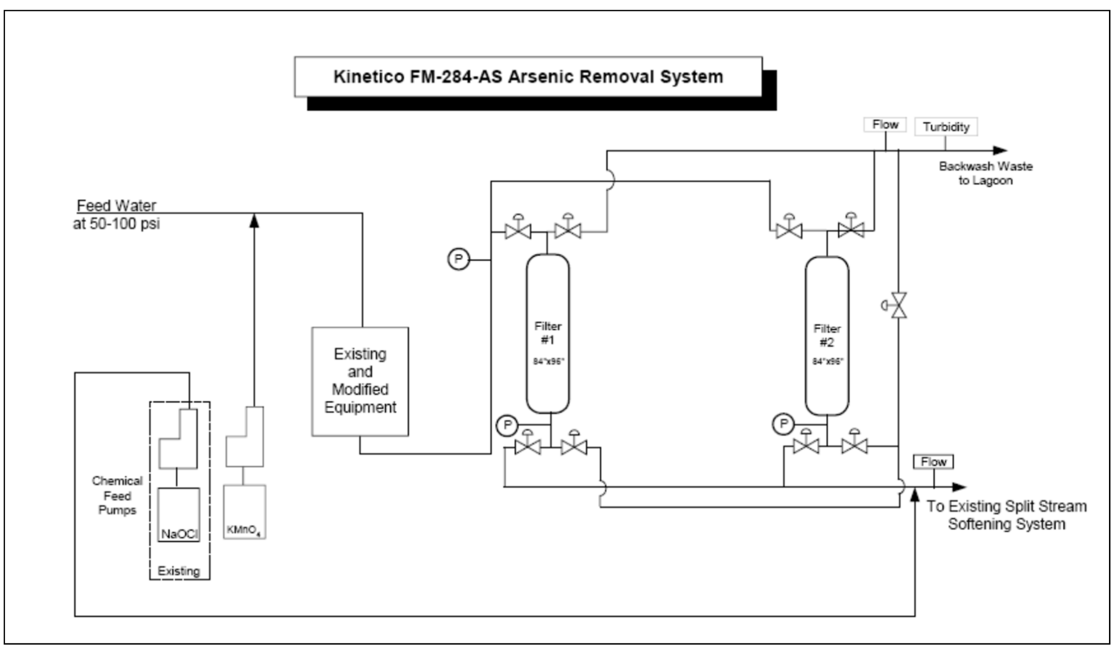


Figure 4-7. Schematic of Kinetico's Macrolite® Arsenic Removal System

Table 4-3. Design Features of Macrolite® System

Parameter	Value	Remarks
$KMnO_4$ dosage (mg/L)	2.6	-
Contact		
No. of Vessel	1	–
Vessel Size (ft)	11 D × 7 H	5,000 gal capacity
Contact Time (min)	6.5	–
Filtration		
No. of Vessels	2	–
Configuration	Parallel	–
Vessel Size (in)	84 D × 96 H	–
Vessel Cross-sectional Area (ft^2)	38.5	–
Media Volume (ft^3/vessel)	75	24-in bed depth of Macrolite®
Hydraulic Loading Rate (gpm/ft^2)	10	385 gpm/vessel
Backwash		
Pressure Drop (psi)	10–12[(a)]	Across a clean bed
Initiating Pressure (psi)	20[(a)]	Across bed at end of filter run
Initiating Standby Time (hr)	48[(a)]	–
Initiating Service Time (hr)	24[(a)]	–
Hydraulic Loading Rate (gpm/ft^2)	8–10	308 to 385 gpm/vessel
Duration (min/vessel)	Variable[(a)]	Based on minimum and maximum backwash time, pressure and turbidity setpoints
Turbidity Set point (NTU)	20[(a)]	To terminate backwash
Wastewater Production (gpd)	Variable[(a)]	Based on PLC set points shown above
Design Specifications		
Peak Flowrate (gpm)	770	–
Maximum Daily Production (gpd)	1,108,800	Based on peak flow, 24 hr/day
Hydraulic Utilization (%)	36%	Estimate based on maximum demand[(b)]

(a) Initial expected values of PLC.
(b) Based on a peak daily demand of 400,000 gpd.

The treatment technology includes the following major process steps and system components:

- **Intake** – Raw water was pumped from both Wells No. 1 and No. 2 to provide a design flowrate of 770 gpm against a 90-psi head. After combined, raw water from both wells flow through a 6-in intake pipe (see Figure 4-8) to a 6-in standpipe inside the aeralater.
- **Oxidation** – Two $KMnO_4$ feed systems were used to oxidize soluble As(III) to soluble As(V) and soluble Fe(II) to Fe(III) solids. Prior to the study, the $KMnO_4$ demand was estimated to be 2.6 mg/L, which was delivered by one 0.42-gal/hr (gph) LMI (A171-155S) and one 0.58-gph LMI (P141-352SI) metering pumps (Figure 4-9) to Wells No. 1 and No. 2 wellheads (see an injection point at wellhead in Figure 4-10). Each chemical feed system also included an impeller/mixer and a 66-gal polyethylene storage tank in a secondary containment (Figure 4-11). $KMnO_4$ was selected because of the elevated ammonia levels (up to 2 mg/L), which were expected to form chloramines upon chlorine addition. Chloramines would result in incomplete oxidation of soluble As(III) to soluble As(V). $KMnO_4$ system operations were tracked by measuring $KMnO_4$ consumption in the storage tank.

Figure 4-8. Intake Piping to Aeralater

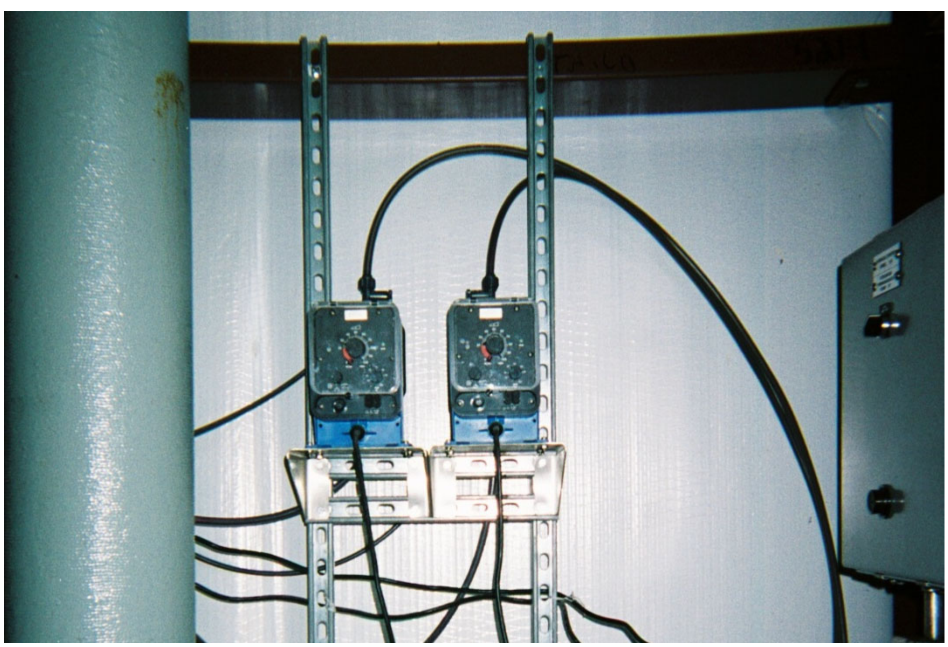


Figure 4-9. Chemical Metering Pumps for $KMnO_4$ Addition

Figure 4-10. $KMnO_4$ Injection Point at Wellhead

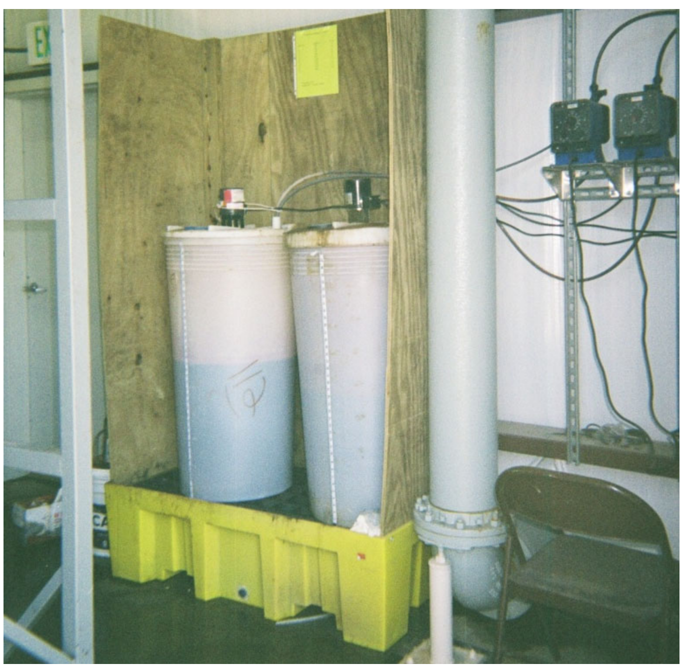


Figure 4-11. Chemical Storage Tanks and Secondary Containments

- **Retention** – After $KMnO_4$ addition, water flowed through the 6-in standpipe before being discharged at the top of the aeralater. The original system design called for the use of the aeralater as a contact tank (not as an aeration unit), which, with its 5,000-gal volume, would provide approximately 6.5 min of contact time to presumably improve the formation of iron flocs prior to pressure filtration.

Inconsistent to what was planned, the aeralater was used as an aerator during a large part of the performance evaluation study. At system startup, the blower at the top of the aeralater was allowed to operate, causing significant biofouling in the Macrolite® filters due to biological activities. The blower was turned off in March 2007, but some aeration apparently continued as water discharged from the standpipe splashed downward through a series of aluminum trays at the top section of the aeralater. In July 2009, the aluminum trays were removed and the 6-in standpipe was cut 4-ft below the high-level sensor in the aeralater. Even with these changes, aeration continued until the aeralater was completely bypassed in March 2010 as discussed in Section 4.5.2.2.

- **Pressure Filtration** – Removal of arsenic-laden iron particles from the aeralater was achieved via downflow filtration through two 84-in × 96-in pressure vessels. The steel vessels were floor mounted, arranged in parallel, and piped to a valve rack mounted on a welded, stainless steel frame (Figure 4-12). Each vessel contained approximately 24 in (or 75 ft^3) of 40/60 mesh Macrolite® media supported by fine garnet underbedding filled to 1 in above a stainless steel wedge-wire underdrain with 0.006-in slots. The steel vessels were coated on the exterior with an epoxy base and the interior was coated with a NSF-approved epoxy coating. The downflow through each vessel was regulated to 385 gpm with a flow-limiting device to prevent filter overrun or damage to the system. The normal system operation with both vessels online provided a total system flowrate of 770 gpm.


c

Figure 4-12. Macrolite Pressure Filters and Valve Rack
(*Before Completion of Enclosure)*

- **Filter Backwash** – At a 10-gpm/ft^2 loading rate and 24 in of depth, the anticipated pressure drop across a clean Macrolite® filter was 10 to 12 psi in the service mode. When the pressure drop across a filter reached 20 psi, both filters were automatically backwashed in an upflow configuration. Backwash also might be triggered by the length of time the filters had been in service and/or in stand-by mode. During a backwash cycle, one filter was backwashed while the other was still in service. Water was drained from the first filtration vessel, which was then sparged with air. After a brief settling period, the filtration vessel was backwashed with treated water until the turbidity of backwash wastewater reached a desired setpoint, as measured by an inline Hach™ turbidimeter. The filtration vessel underwent a filter-to-waste cycle before returning to feed service, and then the second filter was backwashed. The backwash wastewater was sent to a sump that emptied by gravity into a pond (Figure 4-13) located just outside of the treatment plant building.

Figure 4-13. Backwash Wastewater Pond with Storage Tank in Background

- **Softening and Post-Chlorination** – Approximately 70% of the treated water from the Macrolite® filter was fed into the pre-existing water softener. Synthetic zeolite was used to remove hardness from the water and the softened water was subsequently blended with the approximately 30% of the bypass water. The pre-existing pressure filter (120-in × 92-in) was emptied and converted to a softener. After softening, post-chlorination occurred and the water was transferred to the 127,000-gal storage tank for distribution.
- **Storage and Distribution** – Treated water in the 127,000-gal storage tank was transferred by two high service pumps to the 10,000-gal horizontal hydropneumatic tank before entering the distribution system. On/off of the pumps was controlled by a set of high- and low-level sensors in the hydropneumatic tank.

4.3 System Installation

Kinetico completed installation and shakedown of the system on June 23, 2006. The following briefly summarizes system/building installation activities, including permitting, building preparation, system offloading, installation, shakedown, and startup.

4.3.1 Permitting. Design drawings and a process description of the proposed treatment system were submitted on August 19, 2005, by William Jarrell, P.E. of Morgan Goudeau and Associates to LADHH/OPH. LDHH/OPH issued the permit with a letter of no objections on September 16, 2005. Due to elevated As(V) levels in the filter effluent, a permit modification also prepared by William Jarrell, P.E. was submitted on June 21, 2007, and granted on August 8, 2007 for the use of $FeCl_3$ addition.

4.3.2 Building Construction. Building construction began on March 6, 2006, utilizing a pre-engineered metal building extension to house the filtration and softener vessels. A 6-in thick concrete pad was installed from March 6 to 27, 2006, and after allowing time for the concrete pad to cure, a go-ahead was given to the vendor to ship the equipment. Upon arrival on April 10, 2006, the filtration vessels and pipe rack were placed on the concrete pad followed by completion of the building enclosure. The building was 53 ft × 25 ft with a roof height of 16 ft. A 12-ft-wide by 14-ft tall overhead door enabled access to the building. Wastewater discharge was through a 12-in PVC drain line that emptied by gravity from a sump into a 4-ft deep pond (Figure 4-13). Figure 4-14 shows the pre-engineered metal building extension that housed the treatment system, which was placed adjacent to the existing aeralater unit.

Figure 4-14. New Building Constructed Adjacent to Pre-existing Aeralater

4.3.3 System Installation, Startup, and Shakedown. Upon arrival of the system components, Kinetico, through its subcontractor Twico, performed off-loading, placement of the filter vessels and pipe rack onto the concrete pad, and piping modifications (Figures 4-15 and 4-16). Further system installation work was temporarily halted so that building construction could proceed around the system. Kinetico

Figure 4-15. Off-Loading of Pipe Rack for Macrolite® Filtration System

Figure 4-16. Placement of Vessels and Pipe Rack on Concrete Pad Prior to Building Construction

returned to the site from May 22, 2006, to June 7, 2006, to complete installation and shakedown activities, including inlet and distribution piping tie-ins, electrical interlocking, PLC testing, instrument calibration, and media loading and backwashing to remove fines. The system (Figure 4-17) was manually started up on June 7, 2006, to test the pressure filters. Automatic startup was not performed at the time because of several outstanding issues related to the conversion of the pre-existing aeralater to a contact tank (e.g. filter media removal, cleaning, disinfection, as well as chemical feed point and bypass line installation). After United Water Systems addressed these action items, Kinetico returned to the site to continue shakedown activities during the week of June 19, 2006. Operator training occurred on June 22, 2006. The system was started in automatic mode on June 23, 2006.

Battelle performed system inspections and operator training on sample and data collection from August 9 to 11, 2006. As a result of the system inspections, several punch-list items were identified. Table 4-4 summarizes the items identified and corrective actions taken.

Figure 4-17. Completed Treatment Systems

4.3.4 Iron Addition Modification. A permit modification for an iron addition system was prepared by William Jarrell, P.E. and submitted to LADHH/OPH on June 21, 2007, because of higher-than-MCL levels of arsenic in the filter effluent. Approval for iron addition was granted by LADHH/OPH on August 8, 2007, and iron addition was initiated by the operator on December 12, 2007.

Table 4-4. System Inspection Punch-List Items from August 9 to 11, 2006, Site Visit

Item No.	Description	Corrective Action(s) Taken	Resolution Date
1	Move $KMnO_4$ injection to a single point just prior to aeralater	Action item for Kinetico removed on 11/14/06 due to proposed switch to pre-chlorination	11/14/06
2	Change scale of outlet pressure gauge (PI-5) to a 30 psi max range for better reading accuracy	A 0 to 30 psi pressure gauge shipped and installed by operator	01/15/07
3	Determine cause(s) of 2 to 4 psi discrepancies observed between manual gauges and pressure transducers and take necessary measures to fix problems	Manual gauges next to transducers PT2 and PT3 replaced by Kinetico; confirmed with operator that these manual gauges were working and within 1 to 2 psi of pressure transducer (PT2/PT3) readings	12/13/06
4	Determine cause(s) of different backwash flowrate readings observed between PLC panel and digital readouts on meter; perform meter calibration if needed	Three manual backwashes performed by Kinetico and proper calibration of backwash flow meter confirmed; data provided to show comparable PLC readings and digital readouts on meter	11/27/06
5	Adjust backwash flowrates to within design specifications; elevated backwash flowrate at 400 gpm (or 10.4 gpm/ft^2) observed, which might result in media loss based on observations at other arsenic demonstration sites	Backwash flowrate lowered by Kinetico to approximately 380 gpm (inside range of design values of 308 to 385 gpm/vessel [or 8 to 10 gpm/ft^2])	11/28/06
6	Determine cause(s) of system warning light on Hach Turbidimeter, which was lit up on the instrument readout panel during system operation	Hach warning light cleared	11/27/06
7	Determine cause(s) of low flow alarms during backwash, which caused backwash to fail and system to go out of service. Problems reported by operator to Kinetico on August 15, 2006; operator had to acknowledge the alarm and manually backwash system prior to returning to service	Alarm was due to a bad solenoid valve on air bank; lack of backwash flow due to valve not opening. A spare solenoid on the panel was used to fix the valve in question	08/31/06
9	Determine if a flow restrictor should be installed to regulate fast rinse flowrate to ensure proper fast rinse operation; flow restrictors only installed on service line	An orifice plate to control fast rinse flow rate shipped on October 20, 2006, and installed by Kinetico later. Fast rinse flowrate controlled to be within design specification at 280 gpm	11/27/06
10	Determine cause(s) of elevated arsenic levels in filter effluent. On 09/28/06, Kinetico was notified by Battelle that filter effluent was not reaching below 10 µg/L arsenic due to presence of elevated soluble As(V) concentrations	Iron addition initiated on December 12, 2007, but with little improvement; arsenic levels in filter effluent remained elevated for the duration of study	Not resolved

4.4 System Operation

The treatment process as designed would consist of oxidation of soluble As(III) and soluble Fe(II) using $KMnO_4$, adsorption/co-precipitation of soluble As(V) onto iron solids, and Macrolite® pressure filtration for removal of arsenic-laden iron particles. The existing aeralater would be emptied of all internal components and used as a contact tank upstream of the Macrolite® pressure filters. The existing pressure filter would be converted to a softener in its pre-study configuration for hardness removal.

Upon completion of system installation in July 2006, the project team believed that the aeralater had been properly modified to function as a contact tank. It was not until late 2006 and early 2007 when the project team discovered that the aeralater, in fact, had been functioning as an aerator, causing extensive biofouling of the filter media due to microbial activities, including nitrification. Accumulation of bio-solids in the filters significantly increased backwash frequency (from one or two times/day to as many as eight times/day). Efforts to rectify the problems included an acid and a caustic wash of the fouled media in December 2006 and turning off the blower to stop air flow to and aeration in the aeralater in March 2007. To better control biological growth in the filters, both $KMnO_4$ and chlorine (in gas form) were used in late January 2007 and then only chlorine (in gas form) in March 2007 (exacting timing for $KMnO_4$/chlorine and chlorine usage could not be verified). While these changes appeared to alleviate, to some extent, frequent backwash issues, filter effluent continued to contain >10 μg/L of arsenic, existing mostly as soluble As(V), during most sampling events. This prompted a decision to add supplemental iron to raw water, starting on December 12, 2007, to aid in the adsorption/co-precipitation process.

The effect of iron addition was inconclusive due to erratic $FeCl_3$ dosage caused by problems with the chemical feed pump and corrosion and dissolution of the mixing equipment within the day tank. As a result, iron addition not only did not significantly reduce soluble arsenic concentrations, but also added extra solids loading to the pressure filters, resulting in even more frequent backwash. This, along with the fact that piping in the aeralater was modified in July 2009 to minimize aeration of source water in the aeralater, led to the termination of supplemental iron addition in July 2009. Because system performance did not appear to improve, the filter media were acid-washed three times in March, July, and October 2009. Meanwhile, the two flow restrictors located downstream of the filters were unclogged and rubber grommets in the restrictors removed to enhance water flow through the filters (from ~250 to ~450 gpm).

While the system continued to produce effluent with elevated arsenic and iron concentrations, two members of the project team visited the site from January 18 through 22, 2010, to inspect the system and conduct three separate, yet connected tests relating to the performance of and potential future modifications to the system. The tests performed included sampling at the AC sampling location after physical bypass of the aeralater, a series of jar tests relating to oxidant selection and optimal oxidant dose, and a filter run length study to determine useful run length between two consecutive backwash events. The test results led to two recommendations by the project team to permanently bypass the aeralater to minimize aeration prior to the pressure filters and to return to the use of $KMnO_4$ as the oxidant for soluble As(III) and soluble Fe(II) oxidation.

During a following trip from March 17 through 19, 2010, made by Accurate Water Solutions under contract with Battelle, it was noted that the facility had gone ahead to install piping to bypass the aeralater (Figure 4-18). Upon its inspections, Accurate Water Solutions reported, among other issues, potential water hammer problems. After replenishing the filter beds with Macrolite® media, the facility began to operate the system with $KMnO_4$ and performed another acid wash to both filters thereafter in April 2010. A pipe break (Figure 4-19) took place on May 5, 2010, and forced the system to be shut down until May 20, 2010. Soon after the system resumed operation, the facility was issued an administrative order by LDHH/OPH on June 2, 2010 due to exceedance of running annual average of arsenic compliance samples collected during October 1, 2008, through September 30, 2009.

Figure 4-18. Piping Bypassing Pre-existing Aeralater

Figure 4-19. Replacement Steel Pipe (*Vertical Section on Right*) After Pipe Break

The two project team members returned to the site again during July 26 through 31, 2010 to perform two run length tests with the use of bypass piping and $KMnO_4$. While soluble As(V) concentrations were reduced as anticipated, total arsenic concentrations were at or just over the 10-µg/L MCL. In addition, iron broke though the pressure filters within 2 hr of filter runs. A follow-on meeting was convened at EPA National Risk Management Research Laboratory (NRMRL) on September 16, 2010, with representatives from EPA, United Water Systems, and Battelle in attendance. Recommendations were made by meeting attendees to the facility operator concerning ways to verify his observations that the system had produced effluent with arsenic concentrations below the MCL. A decision also was made to immediately end the performance evaluation study due to expiration of the Round 2 demonstration contract between EPA and Battelle. Table 4-5 chronologically summarizes key events that took place during the performance evaluation study.

Table 4-5. Key Events During Performance Evaluation Study at Arnaudville, LA

Date	Problems Encountered	Actions Taken
10/10/06	Higher than MCL levels of soluble As(V) in filter effluent observed since start of study	Kinetico agreed to include iron addition to system
11/06	System experienced increasing backwash frequency (from 2 to 3 times/day to 2 to 8 times/day)	
12/04/06	Battelle informed by Kinetico possible media fouling observed during its site visit in late November 2006	
12/08–12/06		Operator performed an acid and a caustic wash on Macrolite® pressure filters; backwash frequency back to 1 to 2 times/day
Late January–02/19/07		Operator began to use gas chlorine for pre-oxidation (possibly also with the use of some $KMnO_4$)
02/21/07		Battelle met with Kinetico and EPA to discuss operational issues; nitrification determined as cause for biofouling. Measures recommended included: • Stop aeration in aeralater • Apply chlorine shock to filter media periodically • Chlorinate raw water and/or backwash water
03/08/07		Operator turned off aeralater blower
03/19/07		Battelle placed a P.O. with Morgan Goudeau and Assoc. for preparation of an iron addition submittal package for LADHH
04/10/07	Battelle informed Kinetico of decreased filter bed depths (4.0 to 7.5 in)	Kinetico shipped media to facility on 04/26/07 to top off filter beds
04/18/07		Temporarily suspended regular weekly sampling due to on-going operational issues
08/08/07		Received approval from LADHH for iron addition
09/24/07–10/15/07		Operator replenished 7.5-in media into Vessel A and 4-in media into Vessel B; system taken offline
11/05/07		Resumed normal system operation

Table 4-5. Key Events During Performance Evaluation Study at Arnaudville, LA (Continued)

Date	Problems Encountered	Actions Taken
11/19/07		Operator conducted a 3.2-hr run length study; arsenic at 11.4 to 12.9 µg/L measured in filter effluent with no particulate iron breakthrough
12/12/07		Began supplemental iron addition (EPA TOM visited site on 12/11/07)
01/23/08		Resumed weekly sampling; results indicated similar treatment results as compared to no iron addition
02/08–04/08		Increased iron dosage from ~0.5 to 1.2 mg/L (as Fe); total arsenic level reduced to 5.6 µg/L
05/29/08		Operator conducted a run length study; results indicated insufficient chlorine addition during testing (i.e., no arsenic oxidation/co-precipitation/removal occurred)
06/08–09/08	Impeller/mixer corroded, leading to stratification within day tank and inconsistent chemical dosing	Battelle attempted to contact operator regarding need to repeat special study; operator indicated in 09/08 that mixing unit was down and that he would repeat the study once a new mixing unit was installed
10/20/08		Operator repeated run length study; results indicated that ion dose rates were too low
11/08–12/08		Operator worked on iron dose rates, which were either too low or too high; mixing equipment continued to be corroded/dissolved
01/09–05/09	System flowrate gradually reduced to 250 gpm	Battelle attempted to contact operator regarding status of mixing unit and another acid wash, which was carried out in early March; Battelle purchased a new pump and an impeller/mixer for $FeCl_3$ mixing; operator called on 05/14/09 indicating receipt of new mixing equipment and low system flowrate (250 gpm)
06/29/09		Operator informed Battelle that aeration continued in aeralater; Battelle emphasized that aeration must be stopped and that iron addition can be discontinued once aeration is stopped
07/13–20/09		Performed acid wash on media; aluminum trays in aeralater removed and standpipe in aeralater cut approximately 4 ft below high level sensor (explained to Battelle during site visit for jar tests in 01/10)
09/09–10/09	System continued to experience low flowrate	
10/26–28/09		Performed acid wash on media; little improvement on flowrate; identified cause to be a clog in flow restrictors; worked with Kinetico to unclog flow restrictors (by removing sediment and rubber grommets); restored flowrate to ~450 gpm
11/09–01/10	System continued to have early iron and arsenic breakthrough	

Table 4-5. Key Events During Performance Evaluation Study at Arnaudville, LA (Continued)

Date	Problems Encountered	Actions Taken
01/18–22/10		Battelle onsite to perform jar tests, realizing that: • Aeration in aeralater continued (2 to 4 mg/L of DO at AC) • System settings significantly deviated from design settings • Media beds needed replenishment Jar test results indicated that: • Without air, soluble As(V) reduced down to ~5 µg/L with use of $KMnO_4$, suggesting bypassing aeralater could be a solution • Chlorine would leave higher levels of As(III) and Fe(II) at AC
03/17–19/10	Low Δp across vessels (possible channeling?)	Tom Jadach of Accurate Water Solutions visited site to inspect system and observed the following: • Media has bio- and iron fouling; back-to-back acid washes using 10% muriatic acid needed • Media beds are only ~17 in deep; need ~24 ft^3 per vessel • Aeralater bypassing piping already installed; had concerns over water hammer
04/14/10		24 ft^3 media ordered by Battelle (another 24 ft^3 ordered by United Water Systems)
04/19/10		Operator indicated the following: • Both vessels acid washed • Bypassing plumbing completed • System changes made for $KMnO_4$ injection
05/05-20/10	Pipe break at site; system taken offline	Replacement steel piping installed
06/02/10	Administrative order issued by LDH	
07/26-31/10		Battelle onsite to perform run length studies with use of bypass piping and $KMnO_4$: • Experienced early iron breakthrough from filters (within 2 hr) • Soluble As(V) reduced to about 6 µg/L, consistent with results from jar tests • Actual backwash steps not following PLC settings
09/16/10		Meeting convened at EPA/NRMRL with representatives from United Water Systems, EPA, and Battelle: • Operator indicated that system effluent had low iron concentrations due to use of both $KMnO_4$ and chlorine • Recommendations provided by meeting participants to operator regards ways to verify his claims • System performance evaluation study to end immediately due to end of Round 2 contract between EPA and Battelle

4.4.1 Service Operation. The system operational parameters are tabulated and attached as Appendix A with the key parameters summarized in Table 4-6. The performance evaluation study began on July 17, 2006, and ended on September 16, 2010, when the project team met with representative of United Water System at EPA/NRMRL in Cincinnati, OH. The operational parameters were logged only until February 21, 2010. Between July 17, 2006, and February 21, 2010, the system operated for 17,800 (Vessel B) to 18,329 hr (Vessel A) based on two hour meters interlocked with the well pumps. Average daily run times ranged from 4.2 to 23.6 hr/day and averaged 14.0 hr/day for Vessel A and ranged from 4.4 to 23.6 hr/day and averaged 13.9 hr/day for Vessel B. As shown in Figure 4-20, no obvious seasonal variation was observed during the study period.

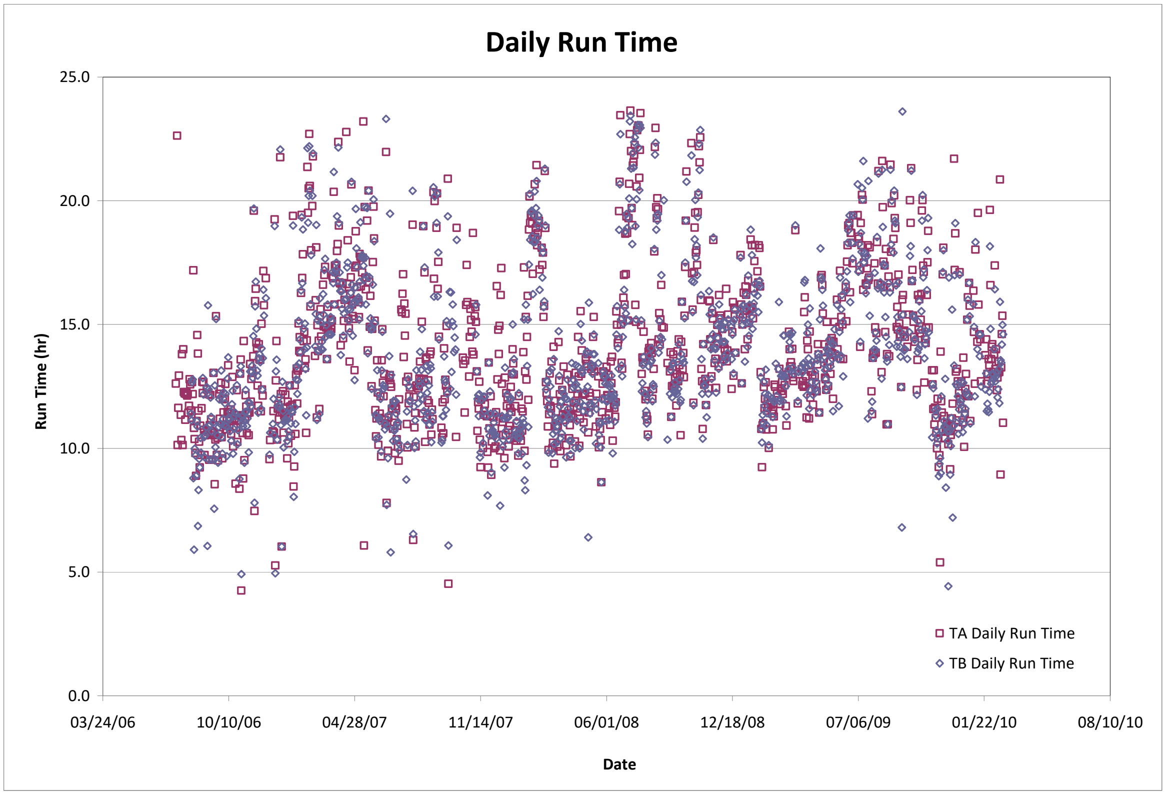


Figure 4-20. Daily Run Time

Daily demands varied between 89,635 and 505,714 gpd and averaged 277,128 gpd, compared to the 280,000 to 380,000 gpd reported by the facility prior to the performance evaluation study. Daily demands were calculated based on incremental readings of a flow meter/totalizer installed at the effluent side of the pressure filters normalized for a 24-hr day. Similar to daily system run times, no obvious seasonal variation was observed during most of the study period. As shown in Figure 4-21, the only clear increasing trend on daily demands appeared to occur during the 2009 summer (before July 2009), but similar increasing trends also were observed during the 2007 to 2008 and 2009 to 2010 winters. At 277,128 gpd, the system operated at 25% of the design capacity (i.e., 770 gpm).

Table 4-6. Treatment System Operational Parameters

Parameter	Value
Operating Period	07/17/06–09/16/10[(a)]
Pretreatment Operation	
$KMnO_4$ Dosage (mg/L)[(b)]	1.8 [0.04–4.7]
Chlorine Dosage (mg/L [as Cl_2])[(c)]	NA
$FeCl_3$ Dosage (mg/L [as Fe])[(d)]	NA
Service Operation	
Total Operating Time (hr)	18,329 (Vessel A) 17,800 (Vessel B)
Daily Operating Time (hr)	14.0 [4.2–23.6] (Vessel A) 13.9 [4.4–23.6] (Vessel B)
System Throughput[(e)] (gal)	363,096,450
Daily Demand (gal)	277,128 [89,635–505,714]
Instantaneous Flowrate (gpm)	335 [136–509]
Calculated Flowrate[(f)] (gpm)	352 [130–673]
Contact Time in Aeralater[(g)] (min)	14.9 [9.8–36.8]
Hydraulic Loading over Pressure Filter[(g)] (gpm/ft^2)	4.4 [1.8–6.6]
System Inlet Pressure (psi)[(h)]	33.0 [18–48]
System Outlet Pressure (psi)[(h)]	15.8 [10–30]
Tank A Outlet Pressure (psi)[(h)]	24.7 [12–44]
Tank B Outlet Pressure (psi)[(h)]	24.2 [10–44]
Δp Across System (psi)[(h)]	16.9 [1–42]
Δp Across Vessel A (psi)[(h)]	7.8 [1–34]
Δp Across Vessel B (psi)[(h)]	8.1 [1–38]
Filter Run Time between Backwashes (hr)	3.9 [0–22.6] (Vessel A) 3.6 [0–22.5] (Vessel B)
Backwash Operation	
Backwash Frequency (time/vessel)	2.2 [0–10] (Vessel A) 2.3 [0–16] (Vessel B)
Number of Backwash Cycles (Vessels A/B)	2,876/3,000
Flowrate[(i)] (gpm)	NA
Hydraulic Loading Rate[(i)] (gpm/ft^2)	NA
Duration (min/tank)[(i)]	NA
Backwash Volume (gal/vessel)	3,376
Filter-to-Waste Volume (gal/vessel)	250
Wastewater Produced (gal/vessel)	724 [596–1,157]

Note: Data presented included average and [range].
(a) Operational data recorded since system startup on 07/17/06 through 02/21/10.
(b) $KMnO_4$ used from system startup in 07/06 through 02/07 and then from 04/10 through end of performance evaluation study in 09/10; tracking of $KMnO_4$ performed only during 07/06 through 02/07.
(c) Gas chlorine used between 02/07 through 04/10; chlorine dosages not tracked.
(d) $FeCl_3$ added during 12/07 through 07/09; iron dosages tracked sporadically during testing.
(e) Estimated based on average instantaneous flowrate (335 gpm) and average filter operating time ([17,800 + 18,329]/2).
(f) Calculated flowrates based on incremental throughput and incremental operating hours.
(g) Based on instantaneous flowrate readings.
(h) After outliers removed.
(i) Data not available due constant changes of flowrate and other backwash settings on PLC.

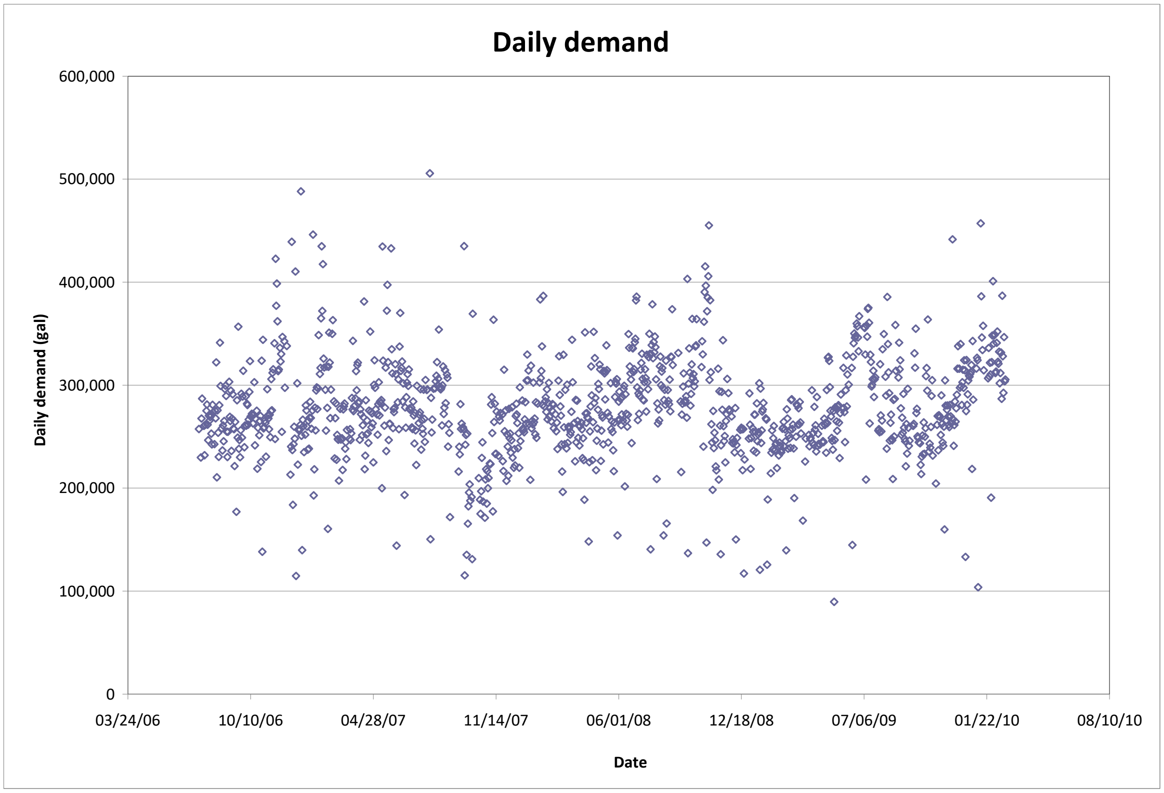


Figure 4-21. Daily Demands During Study Period

System flowrates were tracked by both instantaneous readings of the flow meter and calculated values based on hour meter and flow totalizer readings on the control panel. Instantaneous flowrate readings varied from 136 to 509 gpm and averaged 335 gpm. Calculated flowrate values varied from 130 to 673 gpm and averaged 352 gpm. Although large variations were observed for both instantaneous and calculated flowrates, these flowrate readings/values appeared to agree with one another for the most part as shown in Figure 4-22.

Flowrates during the periods from February 10 through June 5, 2007, from January 29 through February 27, 2008, and from June 20 through August 24, 2008, were significantly reduced to an average of 283, 260, and 250 gpm, respectively, due to failure and/or shutdown of one of the wells caused by various operational issues. Flowrates were gradually reduced from approximately 400 gpm in September 2008 to below 280 gpm by the end of January 2009, and then suddenly increased to over 370 gpm in February 2009. The reason for the sudden increase was an acid wash of the filter media by the operator per Kinetico recommendation. Thereafter, flowrates were gradually decreased again from about 370 gpm to below 270 gpm by October 2009 despite two consecutive acid washes of the filter media in July and October 2009. On October 29, 2009, with Kinetico's assistance, it was determined that the decreasing flowrates were caused by clogged flow restrictors. Upon removal of large flakes of precipitated iron and rubber grommets from the flow restrictors, flowrates were restored to above 400 gpm throughout the remainder of the performance evaluation study.

Using the average instantaneous flowrate of 335 gpm and total number of filter operating time (i.e., average of Vessel A and B operating times –18,065 hr), the total system throughput was estimated to be 363,096,450 gal.

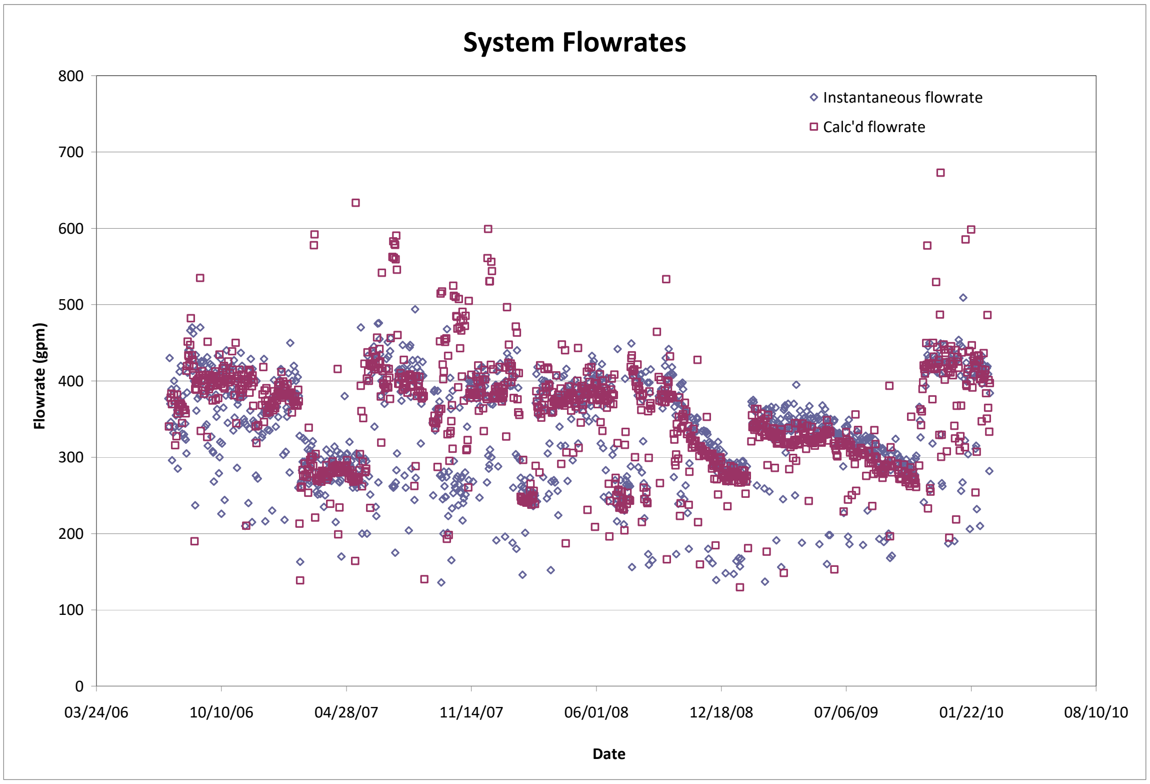


Figure 4-22. System Flowrates

The 335-gpm instantaneous flowrate (on average) corresponded to a contact time of 14.9 min in the aeralater and a filtration rate of 4.4 gpm/ft^2 through the pressure filters. These values were much higher than the design contact time of 6.5 min, but much lower than the design filtration rate of 10 gpm/ft^2.

As shown in Figure 4-23, system outlet pressure readings stayed relatively constant, ranging from 10 to 30 psi and averaging 15.8 psi. System inlet pressure readings, however, varied significantly, ranging from 18 to 48 psi and averaging 33 psi. Variations observed were caused primarily by factors such as number of wells operating, system flowrate, installation of orifice plates, removal of rubber grommets from the flow restrictors, extent of media fouling, depth of filter media, addition of supplemental iron, and stage of filtration runs (e.g., just before or just after backwash), etc. System differential pressure (Δp) readings generally varied according to the system inlet pressure readings, ranging from 1.0 to 42 psi and averaging 16.9 psi.

Δp readings across both pressure filters also varied extensively (Figure 4-24), ranging from 1 to 34 psi for Vessel A and from 1 to 38 psi for Vessel B. As shown in the figure, Δp readings generally decreased from the range of 5 to 20 psi at the beginning of the performance evaluation study to the range of 1 to 5 psi by the end of performance evaluation study. Factors contributing to the decreases included primarily washing away of filter media from the pressure filters (note that the pressure filters were replenished with 4 to 7.5 in of media in April 2007 and 7.5 in of media in April 2010) and especially removal of rubber grommets in October 2009. Due to constant changing of PLC settings and other system operating conditions by the operator as mentioned earlier, it was difficult to pinpoint what exactly had happened during system operation and to interpret system performance using the recorded data such as vessel Δp readings.

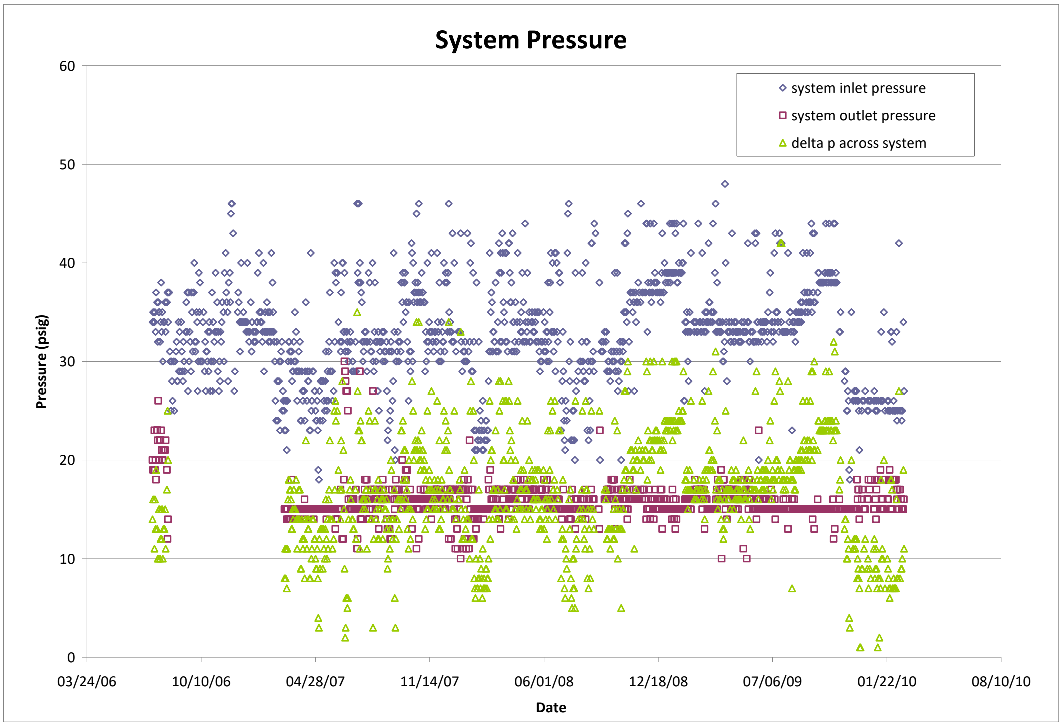


Figure 4-23. System Inlet/Outlet Pressure and Differential Pressure

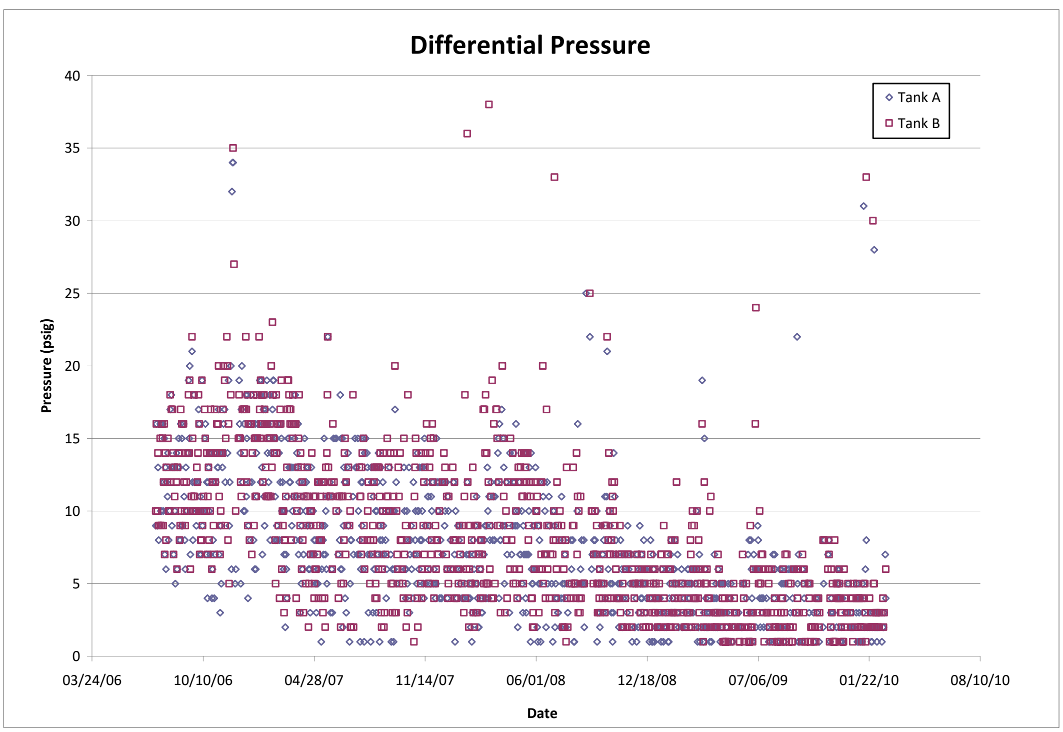


Figure 4-24. Differential Pressure Across Macrolite® Pressure Filters

4.4.2 $KMnO_4$, Chlorine, and Iron Additions. $KMnO_4$ was used initially as an oxidant to oxidize soluble As(III) and soluble Fe(II). Due to biofouling in the pressure filters, $KMnO_4$ was used in conjunction with chlorine in February 2007. In an attempt to more effectively curb biological growth, gas chlorine was used to replace $KMnO_4$ soon afterwards. Meanwhile, $FeCl_3$ was added to supplement natural iron for better soluble As(V) removal in December 2007. After it became clear that aeration in fact was the reason for biofouling and ineffective soluble As(V) removal, addition of $FeCl_3$ was discontinued in July 2009 and $KMnO_4$ was used again as the oxidant in April 2010.

$KMnO_4$ dosages were tracked by measuring daily consumption through solution level changes in the chemical day tanks and daily flow based on the system effluent totalizer. Solution levels in both day tanks were measured daily starting on August 16, 2006, for Tank 1 and on September 25, 2006, for Tank 2. Measurements continued through February 13, 2007, when $KMnO_4$ was replaced with gas chlorine. After $KMnO_4$ was used again as the oxidant in April 2010, changes of solution levels were not recorded. As shown in Figure 4-25, $KMnO_4$ dosages ranged from 0.042 to 4.7 mg/L (as $KMnO_4$) and averaged 1.8 mg/L (as $KMnO_4$). This average dosage was about 30% lower than the target dosage of 2.6 mg/L.

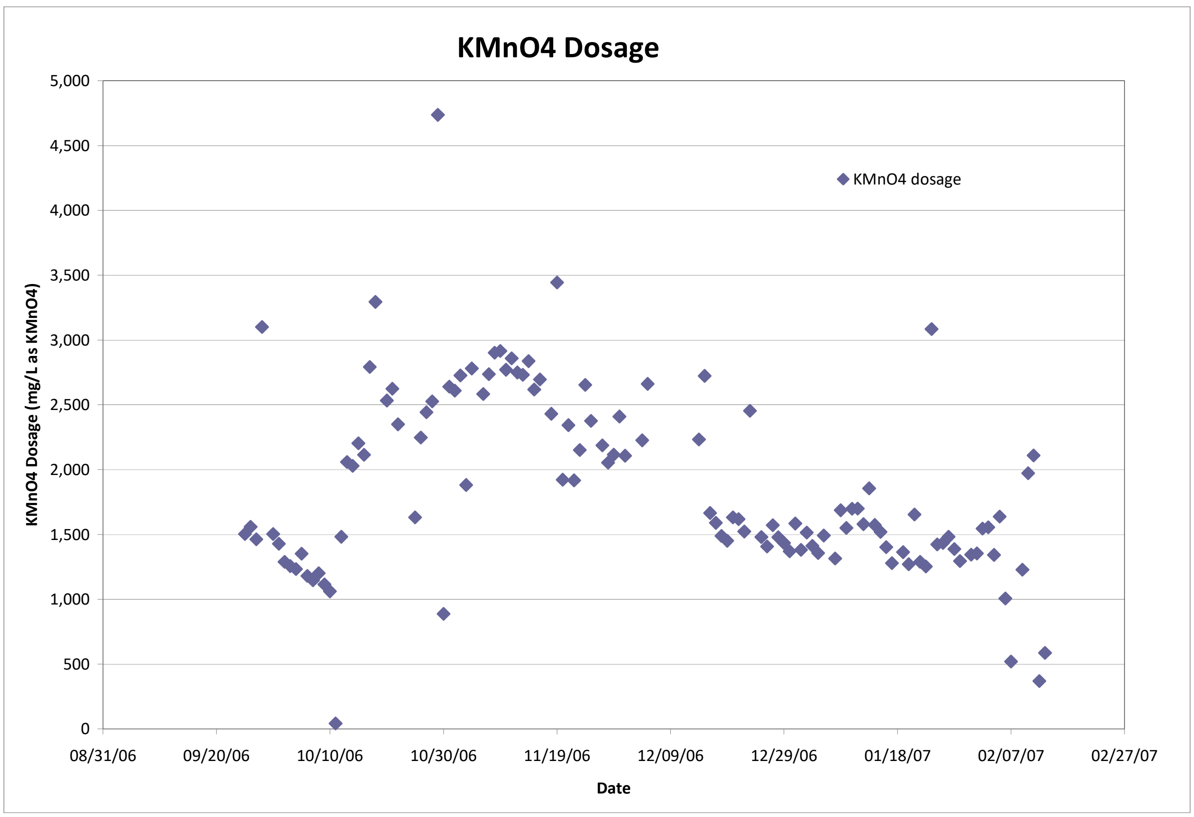


Figure 4-25. $KMnO_4$ Dosages over Time

$KMnO_4$ dosages as plotted in Figure 4-25 were compared with ICP-MS results of samples collected at the AC sampling location (after $KMnO_4$ addition). The amounts of manganese measured by ICP-MS ranged from 1.0 to 2.7 mg/L (as $KMnO_4$) and averaged 1.7 mg/L (as $KMnO_4$). After adjusted with the average amount of manganese in source water (0.4 mg/L [as $KMnO_4$]), the amounts measured due to $KMnO_4$ addition would be 1.3 mg/L (as $KMnO_4$). This amount is 28% lower than the average dosage (1.8 mg/L [as $KMnO_4$]) applied to the treatment system.

After switching from $KMnO_4$ to gas chlorine, chlorine dosages were not tracked. Total chlorine residuals at the AC and TB sampling locations were monitored by the operator using a field Hach meter. Because reporting of the data to Battelle was sporadic and because communications with the operator had been a great challenge, no chlorine usage or residual data could be presented in this report.

Initial sampling results across the treatment train appeared to suggest that there was a need for iron addition in order to reduce arsenic concentrations to below 10 µg/L (although it became evident later that poor arsenic removal observed was caused primarily by the aeration process in the aeralater). Upon LADHH's approval, iron addition was implemented in December 2007. According to the plan, iron dosages should have been tracked by measuring daily consumption of $FeCl_3$ in a day tank and daily flow read from the effluent totalizer. However, tank levels were measured so sporadically (during the period from February 26, 2008, through May 29, 2009) that iron dosages could not be calculated and plotted. Based on the metal analyses as discussed in Section 4.5.1, iron dosages scattered quite extensively, which, among others, might have been caused by an oversized pump and a corroding/dissolving impeller/mixer due to the corrosivity of $FeCl_3$ solution. By May 2009, a more adequately sized pump and a new impeller and a mixer were installed, but logging of daily consumption did not resume. By July 2009, iron addition was discontinued.

4.4.3 Backwash Operation. The two Macrolite® pressure filters were backwashed 2,876 and 3,000 times, respectively. Backwash was triggered mainly by a Δp setpoint. Occasionally, manual backwashes were initiated, but only for testing and sampling of backwash water and solids.

After system startup in July 2006, the pressure filters generally were backwashed once or twice a day (see Figure 4-26). The backwash frequency gradually increased to up to eight times a day by late November 2006. Examination of the filter media indicated significant biofouling, apparently caused by microbial activities as a result of aeration in the aeralater. Immediately after an acid and a caustic wash in early December 2006, the backwash frequency was restored to once or twice a day. Thereafter, the backwash frequency was maintained to mostly once or twice a day through 2007. The use of gas chlorine (to replace $KMnO_4$) in February 2007 and shutting-off of the blower (in the aeralater) in March 2007 apparently helped slow down the biofouling. The acid and caustic wash is discussed in details in Section 4.4.3.2.

Starting from December 2007, iron was added to well water; the backwash frequency increased correspondingly to mostly one to three times a day. Occasionally, the backwash frequency spiked to six or even seven to 16 times a day. By January and February 2009, the backwash frequency increased rather consistently to six to 11 times a day and system flowrates decreased to about 280 gpm. Bio- and iron-fouling were believed to be the main reason for more frequent backwashing. Under Kinetico's instructions, the operator performed the second acid wash to the filter media in early March 2009. Upon completion, the backwash frequency was reduced to mostly three to four times per day, which was somewhat higher than those experienced with iron addition in 2008.

Due to deteriorating flow through the pressure filters after the March 2009 acid wash (from 350 to 270 gpm by October 2009), two additional acid washes were performed in mid-July and late October 2009. These acid washes appeared to be less effective in reducing the backwash frequency and restoring the system flowrates.

The backwash duration for each tank was affected by the minimum and maximum backwash time settings and the ability of the backwash water to meet the turbidity threshold setting as measured by an inline Hach™ turbidimeter. If the backwash water failed to meet the set threshold prior to reaching the maximum backwash time, the backwash failure alarm had to be acknowledged and a successful backwash cycle had to be conducted before the tank could return to the service mode. Backwash was followed by a

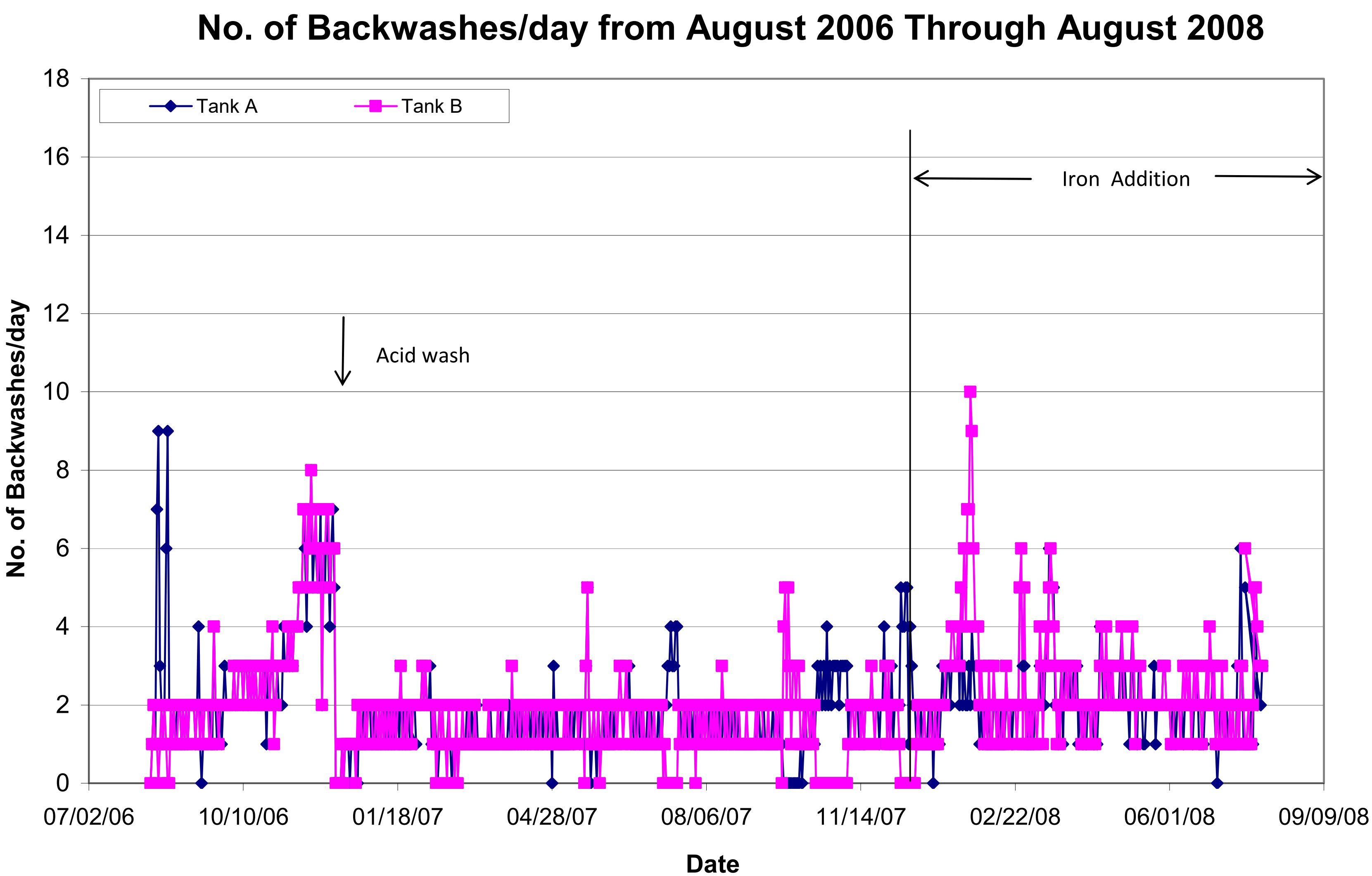


Figure 4-26. Backwash Frequency

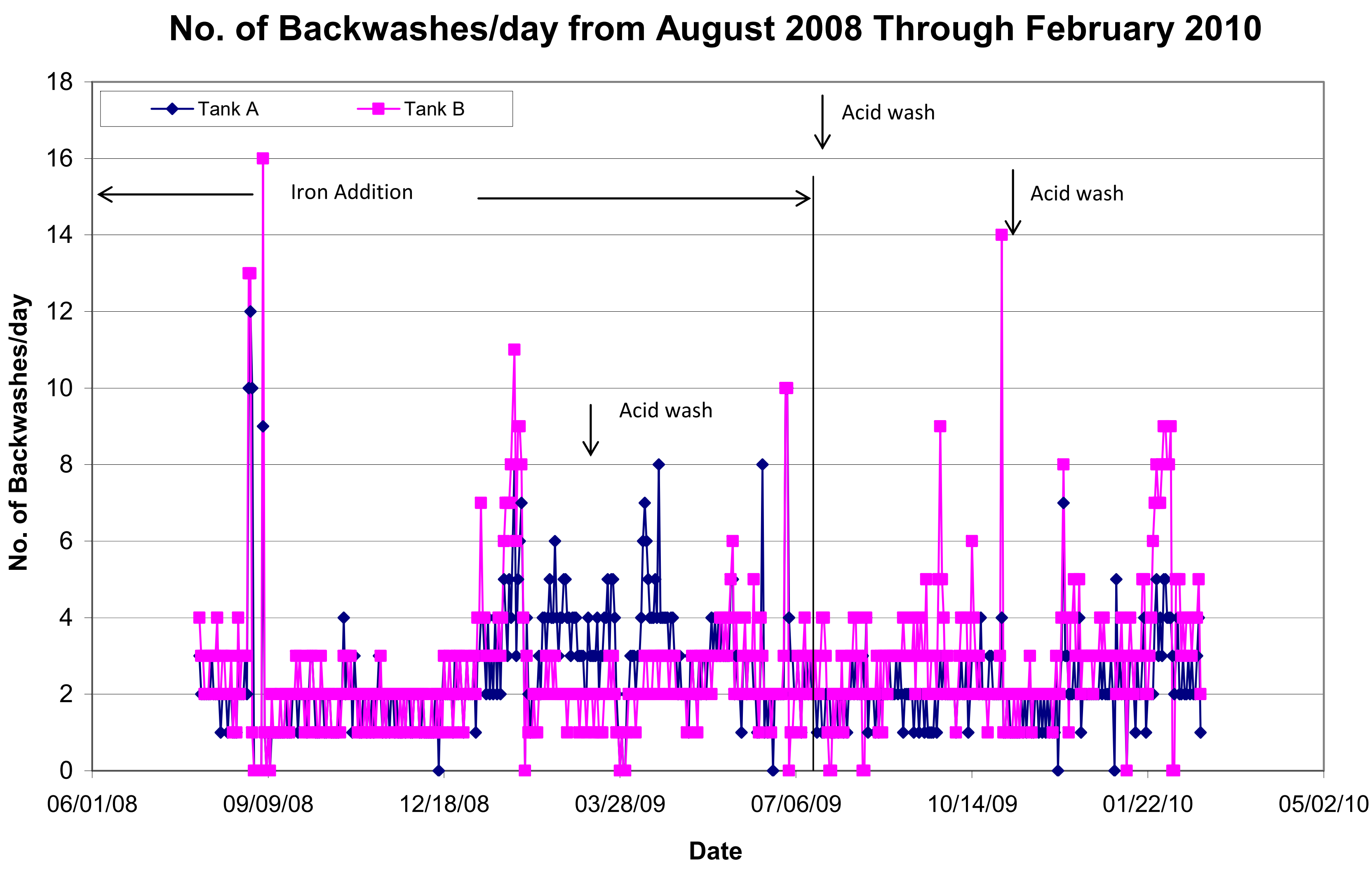


Figure 4-26. Backwash Frequency (Continued)

filter-to-waste step to remove any particulates from the filter. The amount of wastewater produced totaled 19,834,500 gal (or 3,376 gal/vessel), equivalent to 5.5% of the total amount of water treated. This waste to production ratio is significantly higher than those of several similar Macrolite® pressure filtration systems evaluated at other EPA arsenic removal demonstration sites (see Table 4-7). Media fouling and resulting higher backwash frequency apparently contributed to the higher backwash water usage.

Table 4-7. Waste to Production Ratios for Macrolite® Pressure Filters

Site	Design System Flowrate (gpm)	No. of Vessels	Vessel Size (in)	Waste to Production Ratio (%)	References
Arnaudville, LA	770	2	84 × 96	5.5	-
Pentwater, MI	400	2	60 × 96	1.9	Valigore et al., 2008
Felton, DE	375	3	48 × 72	1.5	Chen et al., 2010b
Sabin, MN	250	2	48 × 72	2.5	Chen et al., 2010a
Climax	140	2	36 × 72	1.9–2.4	Condit and Chen, 2006

Assuming a backwash flowrate of 385 gpm, the backwash duration would be 8.8 min. During the performance evaluation study, however, backwash flowrates and other backwash settings were frequently changed by the operator. This, in conjunction with the fact that the inline turbidimeter was not functioning properly during most of system operation, prevented a meaningful estimate of the backwash duration during the study period.

Because of frequent backwashes, filter run times between two consecutive backwashes were short, averaging 3.9 and 3.6 hr for Vessels A and B, respectively. Varying system operating conditions caused filter run times to vary significantly from 0 to 22.6 hr and from 0 to 22.5 hr, for Vessels A and B, respectively.

4.4.3.1 PLC Settings. Table 4-8 presents the PLC backwash settings at system startup on August 10, 2006, and during a site visit on January 18, 2010. One of the most visible discrepancies was the Δp trigger, which was set at 3 psi for both tanks. According to the vendor, the expected clean-bed Δp would be 8 to 10 psi and the recommended Δp trigger should be approximately 10 psi larger than the clean-bed Δp (i.e., ~20 psi). The 3-psi Δp trigger could cause the filters to be backwashed far too frequently.

The actual pressure drop across the pressure filters at the time of data recording was 2.0 psi. The low pressure drop observed might have been caused by factors such as shallow filter beds (indicative of media loss), crusty bed surface, and/or channeling. It was determined later during a site visit by Accurate Water Solutions on March 17 and 18, 2010, that the low pressure drop actually was caused by the removal of rubber grommets in the flow restrictors in October 2009. This was supported by observation of a sudden decrease in inlet pressure and Δp (see Figures 4-23 and 4-24), and a sudden increase in system flowrate (see Figure 4-22).

Both minimum and maximum backwash times were set at 6 min; thus, all backwashes were terminated in 6 min. The filter beds most likely were not completely backwashed in 6 min, as evidenced by the large amount of solids still present in backwash wastewater. The turbidimeter apparently was not working properly. For example, the turbidity reading of a backwash wastewater sample taken by the end of a backwash event showed approximately 40 nephelometric turbidity units (NTU) using a Hach handheld turbidimeter, while the inline turbidimeter read only 5 to 6 NTU. The operator cleaned the turbidimeter with dilute HNO_3, but the cleaning did not seem to solve the problem.

The backwash flowrate observed was 445 gpm (11.7 gpm/ft^2), which was significantly higher than the design value of 310 to 385 gpm (8 to 10 gpm/ft^2). High backwash flowrates could lead to loss of media and need to replenish the filter beds. In fact, both filter beds were replenished twice in April 2007 and April 2010. Nonetheless, the 445-gpm flowrate appeared to be insufficient to fluidize the beds based on an observation made by Accurate Water Solutions during its March 2010 visit.

As noted earlier, backwash settings and other system operating conditions were changed constantly by the operator. The changes were not recorded in the field logs or reported to Battelle's Study Lead. Therefore, it was difficult to track system performance and interpret treatment results based on PLC settings and system operating conditions.

Table 4-8. Snapshots of PLC Backwash Settings

Parameter (for Each Tank)	Recorded Date	
	08/10/06	01/18/10
Drain Time (min)	4	6
Service Time Trigger (hr)	24	24
Standby Time Trigger (hr)	48	48
Δp Trigger (psi)	20	3
Minimum Backwash Time (min)	5	6
Maximum Backwash Time (min)	16	6
Turbidity Threshold (NTU)	20	30
Low Flowrate Threshold (gpm)	200	200
Filter-to-Waste Time (min)	2	2

4.4.3.2 Acid and/or Caustic Washes. When the high backwash frequency was observed in November 2006, samples of Macrolite® media were collected from both pressure filters and sent to Kinetico for analysis. One aliquot of the media was placed in a column, backwashed at 100% bed expansion to remove suspended solids, and removed from the column for visual observation and photographing (Figure 4-27). One portion was then vacuum-filtered and 1.135 g of the moist media was placed in 36 mL of 1% sulfuric acid and heated to nearly boiling. The solution was then filtered and analyzed for iron, manganese, silica, and phosphorus. The results showed 10.6, 1.7, 2.4, and 2.2 mg/g of media for iron, manganese, silica, and phosphorus, respectively. One aliquot each of the vacuum-filtered media was allowed to soak for approximately 67 hr in 10% HCl, 10% NaOH, saturated NaCl, Liquinox, mineral spirits, and methanol. No significant changes to the media were observed except for the HCl-soaked media, which seemed to be coated in an opaque gelatinous substance (Figure 4-28). After the HCl-soaked media was dried at 105 ºC for 1 hr, it exhibited a glazed appearance with some of the gelatinous substance flaking off from the media and attaching to the watch glass (Figure 4-29). Placing the HCl-soaked media in a 20% NaOH appeared to break up the gelatinous coating.

After the laboratory testing, Kinetico recommended to proceed with the acid/caustic washes, but only after it determined that the system components were chemically compatible with the strong acid/base used. A teleconference with the operator on December 8, 2006, however, indicated that the operator had initiated the acid wash. Without recourse, Kinetico agreed to allow the acid to stay in the vessel for 24 hr and the operator performed a system backwash the following morning on December 9, 2006. Because no

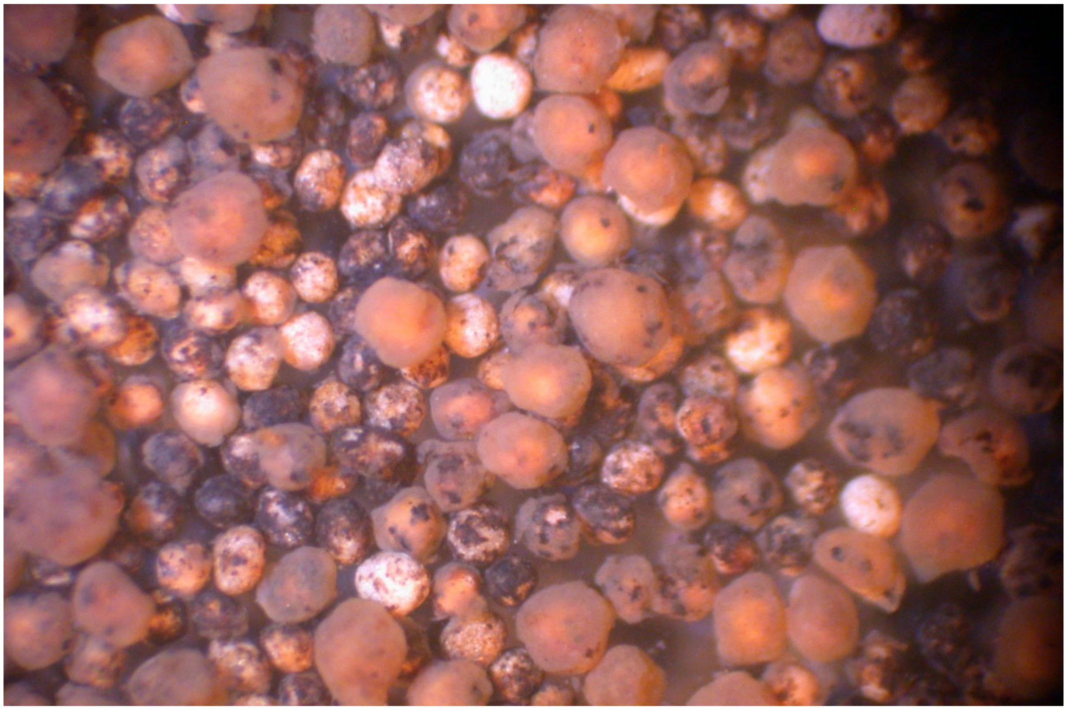


Figure 4-27. Macrolite® Media After Backwash

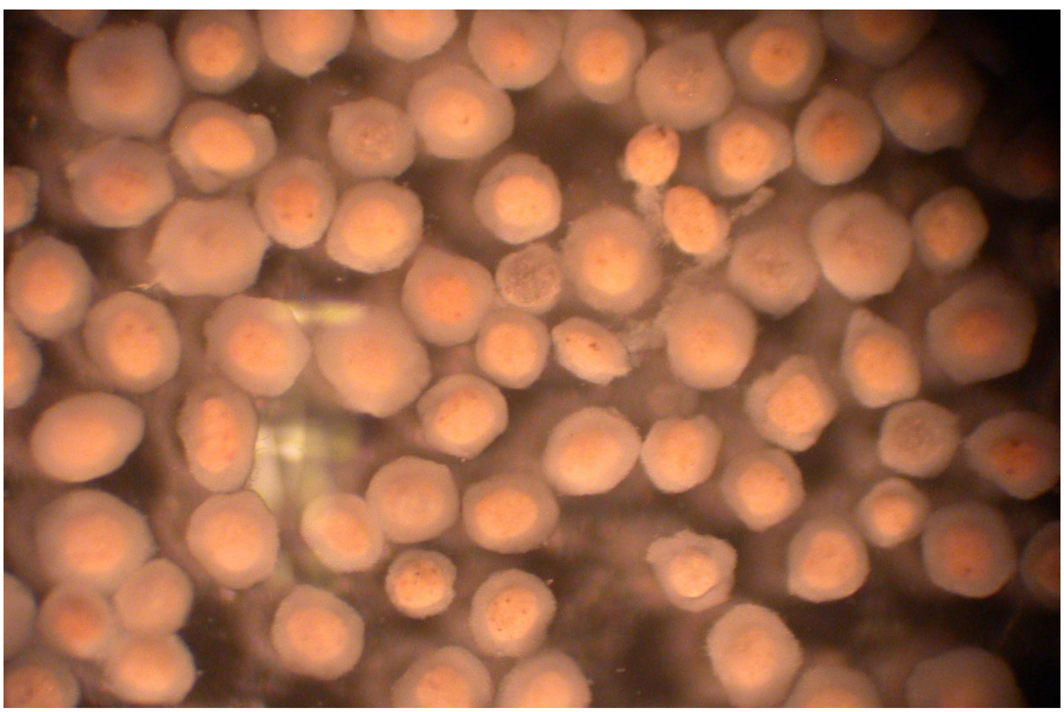


Figure 4-28. Macrolite® Media After Being Soaked in 10% HCl Solution

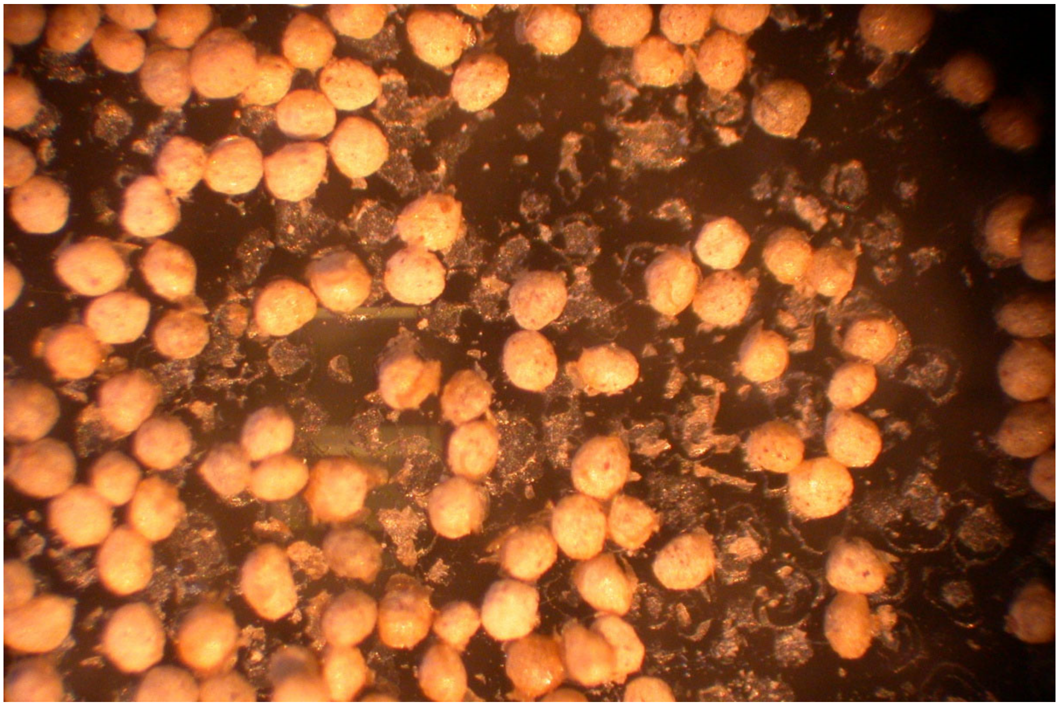


Figure 4-29. HCl-Soaked Media After Drying

written instructions had been provided by Kinetico and no reliable communications had been established between the operator and Battelle, it was not clear how the acid and caustic washes were actually performed at the site.

By March 2007, a set of written procedures was received from Kinetico. Key steps of the procedures are summarized as follows:

- Begin the 10% HCl wash with two back-to-back backwashes on both vessels.
- Isolate the vessel to be washed by disabling the vessel with the touch screen. Also close the hand valves for all service lines so that nothing can enter the vessel during the wash.
- Drain water in the vessel to approximately 1 ft above the media bed.
- Dispense 150 gal of 30% HCl to the media bed. Afterwards, close the top of the vessel and air sparge the media for a minimum of 5 min.
- Continue to air sparge the media for 5 min per hour while the media is being soaked in the acidic solution.
- Allow the media to sit in the acidic solution overnight (more than 20 hr of contact, however, may cause damage to the lower distributors).
- Slowly fill the vessel completely with water; perform backwash to rinse out any remaining acid in the vessel.
- Continue the 10% NaOH wash by repeating the acid wash procedure.
- Dispense 100 gal of 50% caustic into the vessel and allow the media to soak for 2 hr.

- Air sparge the media bed every 15 min.
- Rinse out any remaining NaOH in the vessel with backwash.
- Ensure that all valves are in the correct positions before enabling the vessels on the touch screen and bring the system back online.

Because the media continued to show signs of biofouling and required more frequent backwashing, three additional acid washes were performed by the operator in March, July and October 2009. The amounts of HCl used were 25 and 50 gal for the March and July washes, respectively. The amount used for the October wash was unknown. The amounts used for the March and July washes were significantly lower than the amount (i.e., 150 gal of 30% HCl) recommended by Kinetico; this probably was the reason why these washes were not as effective (in terms of restoring the system flowrate and backwash frequency) as the one performed in December 2006.

4.4.4 Residual Management. Residuals produced by the Macrolite® arsenic removal system included backwash wastewater and filter to waste water, which contained arsenic-laden solids as discussed in Section 4.5.2. Wastewater from backwash was discharged to the building sump, which was emptied by gravity to a pond as shown in Figure 4-13. According to the backwash flow totalizer, 19,834,500 gal of wastewater was produced during the entire study period.

4.4.5 Reliability and Simplicity of Operation. Inability to consistently remove arsenic to <10 μg/L was the main issue encountered during the performance evaluation study. This was caused primarily by the unintended aeration in the pre-existing aeralater and resulting biofouling of the filter media in the pressure filters. Another unfortunate consequence of the unintended aeration was misinterpretation of the above-the-MCL treatment results, which led the project team to conclude that supplemental iron would be needed to enhance arsenic removal. While addition of $FeCl_3$ resulted in little improvement to arsenic removal, additional solid loading to the pressure filters required them to be backwashed even more frequently. Further, chlorine gas was used to replace $KMnO_4$ due to chlorine's ability to better curb biological growth in the pressure filters, but the use of chlorine might not be a good choice due to the presence of ammonia and TOC in source water. The iron addition process was interrupted a number of times due to erratic dosing rates caused by an oversized pump and a corroding/dissolving piece of mixing equipment (i.e., an impeller and mixer). These, in conjunction with the constantly changing PLC settings/operating conditions and lack of timely communications between the operator and Battelle caused the source water (with a complex chemistry) to be inadequately treated and the treatment system to be improperly operated.

The system O&M and operator skill requirements are discussed below in relation to pre- and post-treatment requirements, levels of system automation, operator skill requirements, preventive maintenance activities, and frequency of chemical/media handling and inventory requirements.

4.4.5.1 Pre- and Post-Treatment Requirements. Pretreatment consisted of chemical additions to improve arsenic removal. $KMnO_4$ after proper dilutions was added using two LMI metering pumps to oxidize As(III) and Fe(II). $KMnO_4$ was replaced with gas chlorine using the pre-existing addition system from February 2007 through April 2010. Gas chlorine also was used for post-chlorination to provide chlorine residuals to the distribution system. During December 2007 through July 2009, iron addition was performed using one of the $KMnO_4$ addition systems. The other post-treatment was softening (with 30% bypass). In addition to tracking the depth of the $KMnO_4$, chlorine, and iron solution in the day tanks, the operator measured chlorine concentrations to ensure that residuals existed prior to entering the distribution system.

4.4.5.2 System Automation. The Macrolite® pressure filtration system was automatically controlled by the PLC in the central control panel. The control panel contained a modem and a touch screen OIP that facilitated monitoring of system parameters, changing of system setpoints, and checking the alarm status. Service time, standby time, and Δp settings (Table 4-3) automatically determined when the tanks were backwashed. Due to media fouling and solids loading, Δp setting was responsible for all 3,000 backwashes for each filter. The touch screen OIP also enabled the operator to manually initiate the backwash sequence.

Because the PLC settings and system operating conditions such as backwash flowrate were constantly changed by the operator during system operation, it was difficult to troubleshoot system operational and performance issues and to interpret data, both operational and analytical, for performance improvements.

4.4.5.3 Operator Skill Requirements. Under normal operating conditions, the daily demand on the operator was about 30 min for visual inspection of the system and recording of operational parameters, such as pressure, volume, flowrate, and chemical usage on field log sheets. Due to operational and performance issues, the operator spent a significant amount of time working with the vendor and/or Battelle to assist in troubleshooting and performing special studies.

In Louisiana, an operator of any public water system must hold current and valid professional certification(s) of required categories (i.e., water production, water distribution, and water treatment) at or above the level required for the total system and individual facility. Required levels (classes) of certification for an operator, based on facility classification, are from Classes 1 to 4, with Class 1 being the lowest (serving <1,000 population) and Class 4 the highest (over 25,000 population). Because the system at Arnaudville, LA serves approximately 1,200 connections, the operator needs to have a Class 2 certification (serving 1,001 to 5,000 population).

After receiving proper training during the system startup, the operator understood the PLC, knew how to use the touch screen OIP, and was able to work with the vendor to troubleshoot problems and perform onsite repairs.

4.4.5.4 Preventative Maintenance Activities. The vendor recommended several routine maintenance activities to prolong the integrity of the treatment system (Kinetico, 2005). Daily preventative maintenance tasks included recording pressures, flowrates, chemical drum levels, and visually checking for leaks, overheating components, proper manual valve positioning and pumps' lubricant levels, and any unusual conditions. The vendor recommended weekly checking for trends in the recorded data that might indicate a decline in system performance, and semi-annually servicing and inspecting ancillary equipment and replacing worn components. Cleaning and replacement of sensors and replacement of o-ring seals and gaskets of valves were performed as needed.

4.5 System Performance

The performance of the Macrolite® Arsenic Removal System was evaluated based on analyses of water samples collected from the treatment plant, backwash line, and distribution system.

4.5.1 Treatment Plant Sampling. Treatment plant water was sampled on a total of 69 occasions, including three duplicate events and 41 speciation events. From August 10, 2006, through April 30 2007, 37 sampling occasions took place, including three duplicate events and nine speciation events. After April 30, 2007, sampling was suspended to await the implementation of supplement iron addition. Once iron addition began in December 2007, sampling resumed on January 23, 2008, but was on again and off again until March 30, 2009. During this period, 13 speciation sampling events took place. After supplemental iron addition ended in July 2009, sampling resumed in August 2009 and continued until

February 9, 2010. A single sampling event took place on August 5, 2010, after piping to bypass the aeralater had been installed. From August 18, 2009, through February 9, 2010, 19 speciation sampling events took place.

Tables 4-9 summarizes analytical results of all analytes without iron addition (excluding the August 5, 2010, data after aeralater bypassing). Table 4-10 summarizes analytical results of all analytes with iron addition. The results shown in these two tables represent data impacted, to a varying degree, by aeration in the aeralater. Appendix B contains a complete set of analytical results. The results of the water samples collected across the treatment plant are discussed below.

Table 4-9. Analytical Results (Without Iron Addition)[a]

Parameter	Sampling Location	Unit	Sample Count	Concentration			Standard Deviation
				Minimum	Maximum	Average	
As (total)	IN	µg/L	55	24.1	43.0	32.7	4.9
	AC	µg/L	55	25.3	41.8	33.8	4.2
	TA	µg/L	29	8.7	27.7	13.8	4.0
	TB	µg/L	29	9.5	28.5	14.3	3.9
	TT	µg/L	27	1.4	19.0	11.7	4.3
As (soluble)	IN	µg/L	27	11.1	37.7	29.1	4.7
	AC	µg/L	27	2.2	30.9	13.3	5.2
	TA	µg/L	1	9.6	9.6	9.6	-
	TB	µg/L	1	9.8	9.8	9.8	-
	TT	µg/L	27	0.3	16.2	10.1	3.3
As (particulate)	IN	µg/L	27	<0.1	22.7	2.7	4.6
	AC	µg/L	27	3.6	30.2	19.7	5.2
	TA	µg/L	1	<0.1	<0.1	<0.1	-
	TB	µg/L	1	1.1	1.1	1.1	-
	TT	µg/L	27	<0.1	9.8	1.8	2.7
As(III)	IN	µg/L	27	0.4	35.2	24.4	7.2
	AC	µg/L	27	<0.1	27.2	2.5	5.4
	TA	µg/L	1	1.5	1.5	1.5	-
	TB	µg/L	1	1.4	1.4	1.4	-
	TT	µg/L	27	0.1	5.6	1.2	1.2
As(V)	IN	µg/L	27	<0.1	19.9	4.7	5.1
	AC	µg/L	27	1.3	19.0	10.8	3.6
	TA	µg/L	1	8.0	8.0	8.0	-
	TB	µg/L	1	8.4	8.4	8.4	-
	TT	µg/L	27	<0.1	14.1	9.0	3.1
Fe (total)	IN	µg/L	55	1,477	2,939	2,059	279
	AC	µg/L	55	1,385	2,701	1,995	285
	TA	µg/L	29	<25	92.7	17.6	17.2
	TB	µg/L	29	<25	149	21.6	32.2
	TT	µg/L	27	<25	1,037	166	264
Fe (soluble)	IN	µg/L	27	<25	3,276	1,906	683
	AC	µg/L	27	<25	1,956	97	373
	TA	µg/L	1	<25	<25	<25	0.0
	TB	µg/L	1	<25	<25	<25	0.0
	TT	µg/L	27	<25	<25	<25	0.0

Table 4-9. Analytical Results (Without Iron Addition)[(a)] (Continued)

Parameter	Sampling Location	Unit	Sample Count	Concentration			Standard Deviation
				Minimum	Maximum	Average	
Mn (total)	IN	μg/L	55	96.2	196	133	20.4
	AC	μg/L	55	90.2	932	334	262
	TA	μg/L	29	21.3	605	240	144
	TB	μg/L	29	101	1,443	316	263
	TT	μg/L	27	99.9	384	151	78.1
Mn (soluble)	IN	μg/L	27	28.9	180	130	28.2
	AC	μg/L	27	21.4	478	166	126
	TA	μg/L	1	135	135	135	-
	TB	μg/L	1	136	136	136	-
	TT	μg/L	27	20.2	394	151	85.8
Total Hardness (as $CaCO_3$)	IN	mg/L	26	193	440	278	55.1
	AC	mg/L	26	198	438	271	54.1
	TA	mg/L	1	215	215	215	-
	TB	mg/L	1	222	222	222	-
	TT	mg/L	26	187	439	267	54.5
Ca Hardness (as $CaCO_3$)	IN	mg/L	26	104	316	182	47.1
	AC	mg/L	26	107	316	178	46.6
	TA	mg/L	1	128	128	128	-
	TB	mg/L	1	133	133	133	-
	TT	mg/L	26	100	316	175	46.6
Mg Hardness (as $CaCO_3$)	IN	mg/L	26	77.1	124.4	95.5	11.4
	AC	mg/L	26	75.8	122.4	92.4	11.2
	TA	mg/L	1	86.2	86.2	86.2	-
	TB	mg/L	1	89.0	89.0	89.0	-
	TT	mg/L	26	72.3	123.8	92.0	10.4
Fluoride	IN	mg/L	27	0.1	0.3	0.2	0.05
	AC	mg/L	27	<0.1	0.3	0.2	0.05
	TA	mg/L	1	0.2	0.2	0.2	-
	TB	mg/L	1	0.2	0.2	0.2	-
	TT	mg/L	27	<0.1	0.8	0.2	0.2
Nitrate (as N)	IN	mg/L	27	<0.05	<0.05	<0.05	0.0
	AC	mg/L	27	<0.05	0.1	<0.05	0.0
	TA	mg/L	1	<0.05	<0.05	<0.05	-
	TB	mg/L	1	<0.05	<0.05	<0.05	-
	TT	mg/L	27	<0.05	0.6	0.1	0.2
Ammonia (as N)	IN	mg/L	27	1.5	2.2	1.9	0.1
	AC	mg/L	27	0.9	2.0	1.7	0.2
	TA	mg/L	1	1.9	1.9	1.9	-
	TB	mg/L	1	1.9	1.9	1.9	-
	TT	mg/L	27	0.2	2.0	1.4	0.5
Sulfate	IN	mg/L	27	<0.1	0.5	0.2	0.2
	AC	mg/L	27	<0.1	0.5	0.2	0.2
	TA	mg/L	1	<0.1	<0.1	<0.1	-
	TB	mg/L	1	<0.1	<0.1	<0.1	-
	TT	mg/L	27	<0.1	0.5	0.2	0.2
Silica (as SiO_2)	IN	mg/L	55	38.4	49.3	42.5	2.6
	AC	mg/L	55	40.3	50.0	43.3	2.5
	TA	mg/L	29	39.6	50.1	41.9	1.9
	TB	mg/L	29	38.0	49.6	41.8	2.0
	TT	mg/L	27	39.8	49.6	44.5	3.1

Table 4-9. Analytical Results (Without Iron Addition)[(a)] (Continued)

Parameter	Sampling Location	Unit	Sample Count	Concentration			Standard Deviation
				Minimum	Maximum	Average	
Phosphorus (as P)	IN	μg/L	38	474	873	648	94.8
	AC	μg/L	38	585	819	714	51.6
	TA	μg/L	28	149	278	199	27.7
	TB	μg/L	28	112	298	199	34.2
	TT	μg/L	10	177	323	225	43.5
TOC	IN	mg/L	24	<1.0	1.9	1.3	0.4
	AC	mg/L	24	1.0	2.4	1.4	0.3
	TA	mg/L	2	1.2	1.4	1.3	0.1
	TB	mg/L	2	1.2	1.4	1.3	0.1
	TT	mg/L	23	<1.0	1.7	1.2	0.4
Alkalinity (as $CaCO_3$)	IN	mg/L	55	290	368	333	14.1
	AC	mg/L	55	294	368	337	17.1
	TA	mg/L	29	312	359	336	11.2
	TB	mg/L	29	317	371	337	11.8
	TT	mg/L	27	302	354	326	15.6
Turbidity	IN	NTU	55	9.2	38.0	25.1	5.6
	AC	NTU	55	1.7	16.0	4.2	2.7
	TA	NTU	29	0.1	7.2	0.8	1.3
	TB	NTU	29	0.1	4.4	0.7	0.8
	TT	NTU	27	0.1	2.1	0.7	0.5
pH	IN	S.U.	27	6.0	7.0	6.8	0.2
	AC	S.U.	27	7.0	7.4	7.3	0.1
	TA	S.U.	19	7.2	7.5	7.3	0.1
	TB	S.U.	20	7.2	7.5	7.3	0.1
	TT	S.U.	7	7.3	7.5	7.4	0.1
Temperature	IN	°C	27	14.6	25.0	20.9	2.5
	AC	°C	26	16.6	25.0	21.3	2.3
	TA	°C	20	17.3	24.9	21.3	2.0
	TB	°C	20	17.5	25.0	21.3	2.0
	TT	°C	7	16.8	25.0	21.0	3.2
DO	IN	mg/L	26	0.9	4.7	2.8	0.8
	AC	mg/L	26	3.1	7.2	5.5	0.8
	TA	mg/L	19	2.1	6.2	3.8	1.2
	TB	mg/L	19	1.6	6.1	3.7	1.4
	TT	mg/L	7	3.1	5.6	4.1	1.0
ORP	IN	mV	26	-6.7	428	266	188
	AC	mV	27	140	479	335	93.0
	TA	mV	19	207	479	347	87.5
	TB	mV	19	213	463	358	78.2
	TT	mV	7	247	415	353	70.3

(a) Excluding the event on August 5, 2010 (after piping to bypass aeralater had been installed).

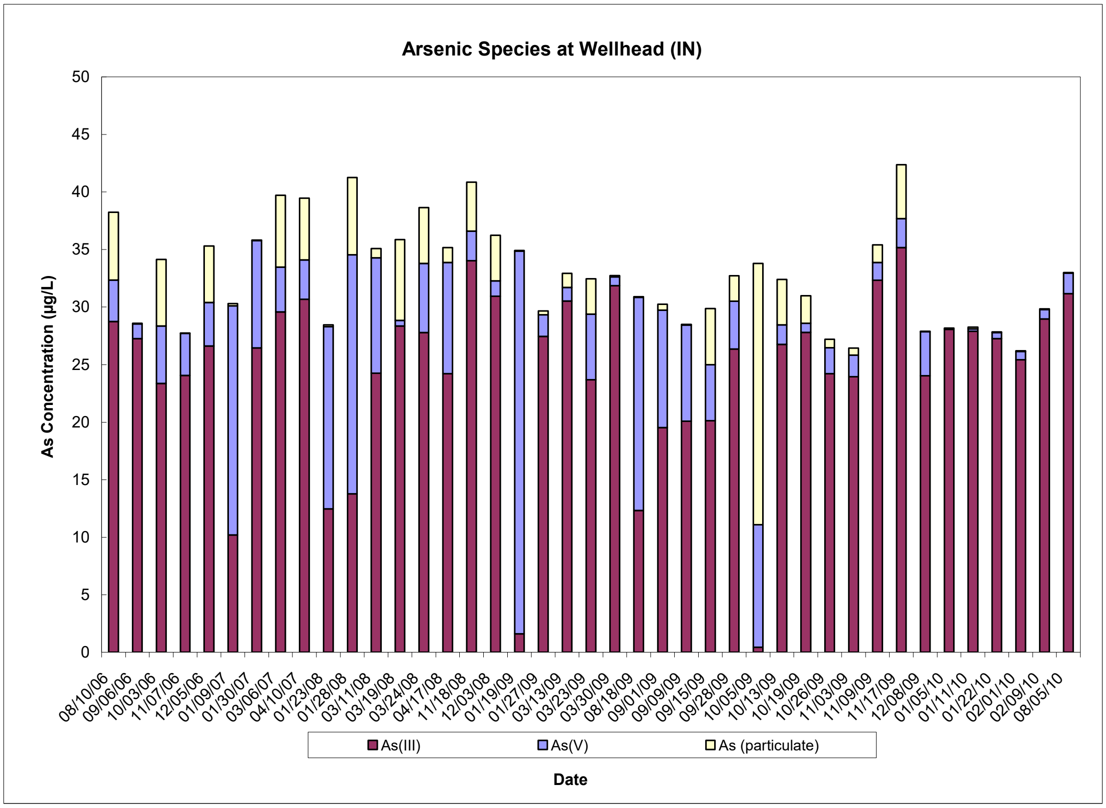
4.5.1.1 Arsenic. Figure 4-30 presents the results of all 41 speciation events, including nine, 13, and 19 before, during, and after iron addition, respectively. As shown on the first bar chart (for samples collected at the wellhead [IN]) and Tables 4-9 and 4-10, total arsenic concentrations in raw water ranged from 24.1 to 43.0 μg/L and averaged 33.1 μg/L with 91% (on average) existing in the soluble form. Of the soluble fraction, As(III) (scarlet on bar charts) was the predominant species with concentrations ranging from 0.4 to 35.2 μg/L and averaging 24.2 μg/L. Low levels of As(V) (blue on bar charts) also were present, ranging from <0.1 to 33.3 μg/L and averaging 5.9 μg/L. The range of total arsenic

Table 4-10. Analytical Results (with Iron Addition)

Parameter	Sampling Location	Unit	Sample Count	Concentration			Standard Deviation
				Minimum	Maximum	Average	
As (total)	IN	µg/L	13	28.5	41.3	34.8	3.9
	AC	µg/L	13	18.7	41.8	34.1	5.5
	TT	µg/L	13	5.6	22.8	11.0	4.4
As (soluble)	IN	µg/L	13	28.3	36.6	32.3	2.7
	AC	µg/L	13	2.5	14.9	9.5	3.6
	TT	µg/L	13	4.7	12.6	8.1	2.2
As (particulate)	IN	µg/L	13	0.1	7.0	2.6	2.5
	AC	µg/L	13	7.7	34.4	24.7	7.0
	TT	µg/L	13	0.2	10.2	2.9	3.0
As(III)	IN	µg/L	13	1.6	34.0	23.9	9.3
	AC	µg/L	13	0.3	1.3	0.8	0.3
	TT	µg/L	13	0.2	1.2	0.8	0.3
As(V)	IN	µg/L	13	0.5	33.3	8.4	9.8
	AC	µg/L	13	1.7	14.0	8.6	3.6
	TT	µg/L	13	3.9	11.8	7.3	2.2
Fe (total)	IN	µg/L	13	1,768	8,045	2,629	1,641
	AC	µg/L	13	701	9,399	3,173	2,216
	TT	µg/L	13	<25	1,763	360	587
Fe (soluble)	IN	µg/L	13	<25	6,314	2,188	1,473
	AC	µg/L	13	<25	32.2	16.5	7.7
	TT	µg/L	13	<25	<25	<25	0.0
Mn (total)	IN	µg/L	13	107	195	130	23.0
	AC	µg/L	13	106	170	129	18.6
	TT	µg/L	13	76.3	156	116	22.6
Mn (soluble)	IN	µg/L	13	109	199	133	23.2
	AC	µg/L	13	90.8	155	117	18.6
	TT	µg/L	13	76.4	157	117	20.2
P (as P)	IN	µg/L	3	726	832	787	55.1
	AC	µg/L	3	779	1,718	1,106	530
	TT	µg/L	3	108	172	143	32.5

concentrations measured was slightly higher than that of historic data, i.e., 17.0 to 37.0 µg/L, as shown in Table 4-1.

As shown on the second bar chart (for samples collected after the contact tank [AC]), $KMnO_4$ was effective in converting soluble As(III) to either soluble As(V) or particulate arsenic, with soluble As(V) concentrations ranging from 6.9 to 16.2 µg/L and averaging 10.8 µg/L and particulate arsenic concentrations ranging from 13.0 to 28.1 µg/L and averaging 20.4 µg/L. The high soluble As(V) concentrations measured were contrary to what would be anticipated because of a high soluble iron to soluble arsenic ratio (i.e., 1,998 µg/L:30.1 µg/L = 66.4 [see Tables 4-9 and 4-10]) in source water. In fact, soluble As(V) concentrations at the AC location were found to be higher or close to the 10-µg/L MCL during 16 of the 28 speciation events (whether $KMnO_4$ or chlorine was used as an oxidant). The rule of thumb was that soluble As(V) formed from soluble As(III) oxidation would be attached to iron solids via adsorption and/or co-precipitation as long as the soluble iron concentration is at least 20 times the soluble arsenic concentration (Sorg, 2002). The presence of high amounts of soluble As(V) in the filter influent were not desirable because the Macrolite® media presumably would remove only particulate arsenic, leaving soluble As(V) and residual soluble As(III) in the filter effluent. This was what prompted



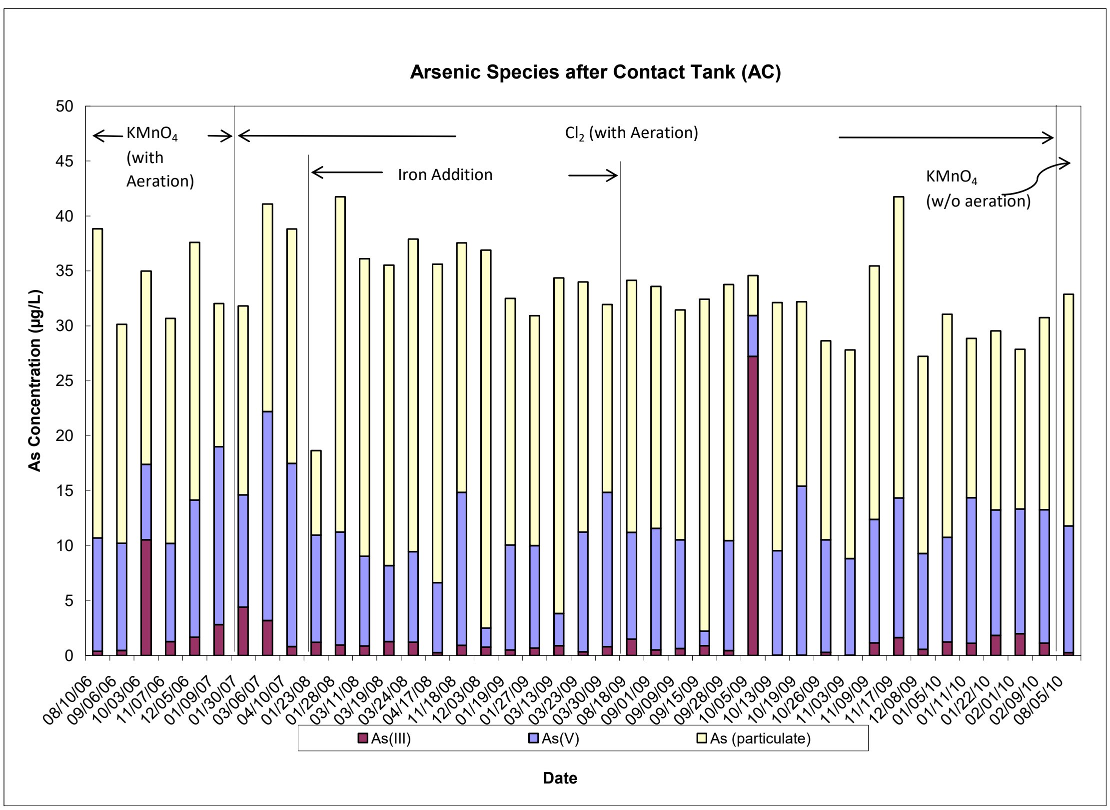


Figure 4-30. Arsenic Speciation Results at IN, AC, and TT Sampling Locations

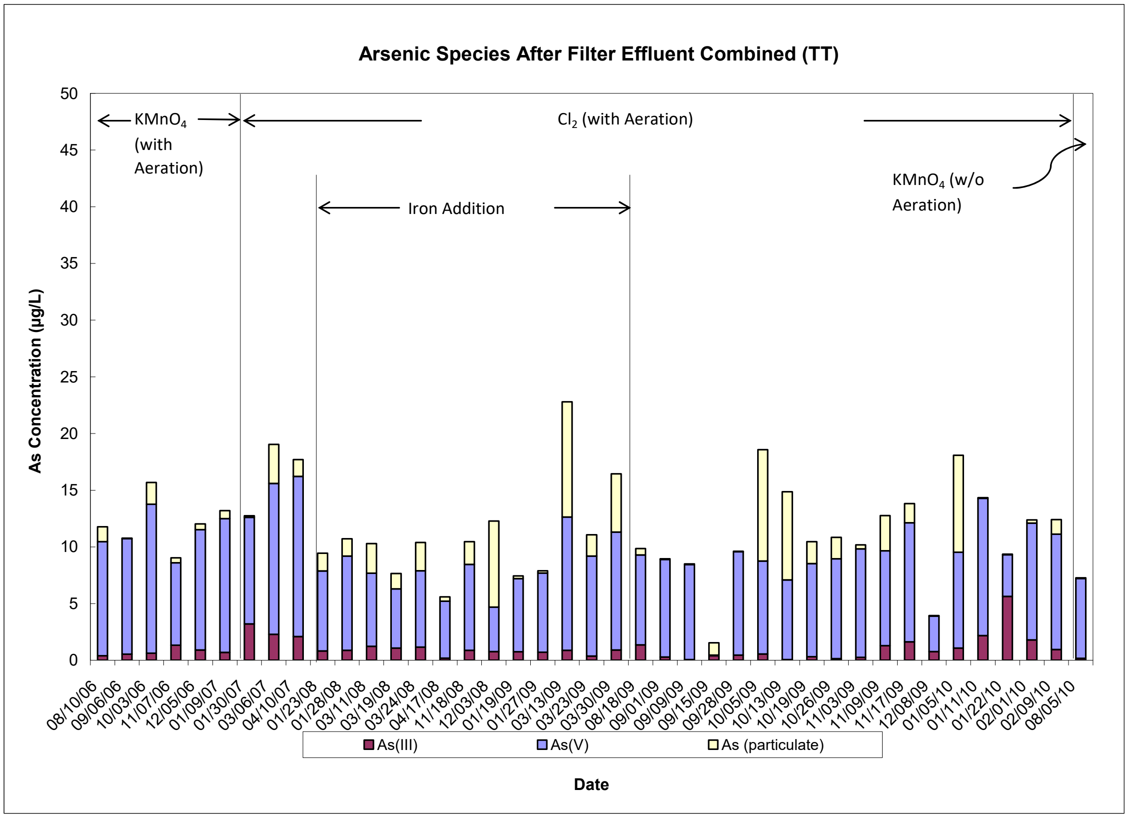


Figure 4-30. Arsenic Speciation at IN, AC, and TT Sampling Locations (Continued)

the decision, made almost immediately after the treatment plant water sampling had begun, to add supplemental iron to the inlet water to enhance arsenic removal.

On October 3, 2006, as much as 10.5 µg/L of soluble As(III) was measured after the contact tank, presumably caused by an unusually low $KMnO_4$ dosing rate as reflected by the low manganese concentration, i.e., 361 µg/L [as Mn] or 1.0 mg/L [as $KMnO_4$] measured in the same sample. The target $KMnO_4$ dosage was 2.6 mg/L (as $KMnO_4$).

Due to concerns over biofouling in the media beds, gas chlorine was used to replace $KMnO_4$ by late January 2007. Immediately after the oxidant replacement, soluble As(III) concentrations at the AC location increased to 4.4 and 3.2 µg/L on January 30 and March 6, 2007. Incomplete soluble As(III) oxidation might have been caused by the presence of ammonia (1.9 mg/L [as N]), which formed chloramines with chlorine. Chloramines are known to react less effectively with As(III) (Frank and Clifford, 1986; Ghurye and Clifford, 2001). Elevated As(III) concentrations did not reoccur after the sampling event on March 6, 2007.

On October 5, 2009, as much as 27.0 µg/L of soluble As(III) was measured at the AC location. This uncharacteristically high soluble As(III) concentration was thought to have been caused by the lack of chlorine addition, although the operator did not report any irregularity during this study period. Because the soluble iron concentration in the same sample also was unusually high (1,956 µg/L), malfunctioning of the gas chlorine addition system most likely was the case. Aeration in the aeralater did not appear to have oxidized much of the soluble iron either when comparing its concentration with that of total iron.

No DO or ORP data were available to support or refute this. Onsite measurements for pH, temperature, DO, and ORP were discontinued by the operator on April 30, 2007.

A number of factors potentially could affect soluble As(V) adsorption onto and co-precipitation with iron solids. Competing anions, such as phosphorus and silica, could use up some adsorption sites. Phosphorus concentrations in source water ranged from 474 to 873 μg/L (as P) and averaged 658 μg/L (as P) (see Tables 4-9 and 4-10). Phosphorus concentrations at the AC location ranged from 585 to 819 μg/L (as P) and averaged 714 μg/L (as P) (see Table 4-9). Although phosphorus concentrations at the AC location were similar to those in source water, its concentrations were significantly reduced after Macrolite pressure filters (to 199 and 225 μg/L [as P], on average, at the TA/TB and TT locations, respectively). Silica concentrations in source water ranged from 38.4 to 49.3 mg/L (as SiO_2) and averaged 42.5 mg/L (as SiO_2). Its concentrations at the AC, TA, TB, and TT locations remained relatively constant at 43.3, 41.9, 41.8, and 44.5 mg/L (as SiO_2). Based on the concentrations at the TA and TB locations, some silica might have been removed along with iron solids, similar to what had occurred for phosphorus.

The other factor that might have impacted soluble As(V) removal was aeration in the aeralater. Although $KMnO_4$ or chlorine was added to either the wellheads or the 6-in standpipe prior to the aeralater, some soluble iron might have reached the aeralater and precipitated upon aeration. Based on field measurements, DO concentrations at the wellhead were 2.8 mg/L (note that results of two special studies conducted onsite showed <0.2 mg/L of DO at the wellheads); DO concentrations after the aeralater increased significantly to 5.5 mg/L. According to the results of the same special studies, soluble As(V) concentrations were reduced to below 5.9 mg/L after $KMnO_4$ oxidation (with most converted to particulate arsenic) if DO levels were kept at the wellhead levels (see Section 4.5.2.3).

Without supplemental iron addition, total arsenic concentrations following the pressure filters at the TA, TB, and TT locations ranged from 1.4 to 28.5 μg/L and averaged 13.3 μg/L (Table 4-9 and Figure 4-31). Arsenic existed primarily in the soluble form with concentrations ranging from 0.3 to 16.2 μg/L and averaging 10.1 μg/L. As expected, soluble As(V) was the predominant species, with concentrations ranging from <0.1 to 14.1 μg/L and averaging 9.0 μg/L (see the third bar chart in Figure 4-30) . It is obvious that soluble As(V) must be converted to particulate arsenic before it can be removed by the pressure filters. The amount of particulate arsenic was low, ranging from <0.1 to 9.8 μg/L and averaging 1.7 μg/L (light yellow on the bar chart). Elevated particulate arsenic concentrations usually were associated with elevated particulate iron concentrations (see Appendix B for particulate arsenic and particulate iron data at the TT location: 9.8 and 790 μg/L, respectively, on October 5, 2009; 7.8 and 732 μg/L, respectively, on October 13, 2009; and 8.5 and 1,037 μg/L, respectively, on January 5, 2010) and thus iron leakage through the pressure filters.

The effect of iron addition was minimal, slightly decreasing the average soluble arsenic concentration from 13.3 (without iron addition) to 9.5 μg/L (with iron addition) and average soluble As(V) concentration from 10.8 (without iron addition) to 8.6 μg/L (with iron addition) at the AC location (Tables 4-9 and 4-10 and the second bar chart in Figure 4-30). After the Macrolite® pressure filters, total arsenic concentrations were reduced to 11.0 μg/L (on average), with 7.3, 0.8, and 2.9 μg/L existing as soluble As(V), soluble As(III), and particulate arsenic. Although more soluble arsenic was converted to particulate arsenic due to iron addition, extra solids loading to the pressure filters caused more particulate arsenic to penetrate through the filters. As a result, little or no benefit was realized from the use of supplemental iron.

4.5.1.2 Iron. Figure 4-32 presents three bar charts showing soluble and particulate concentrations measured at the IN, AC, and TT locations. Total iron concentrations in source water ranged from 1,477 to 8,045 μg/L and averaged 2,168 μg/L, existing almost entirely in the soluble form. The amounts of

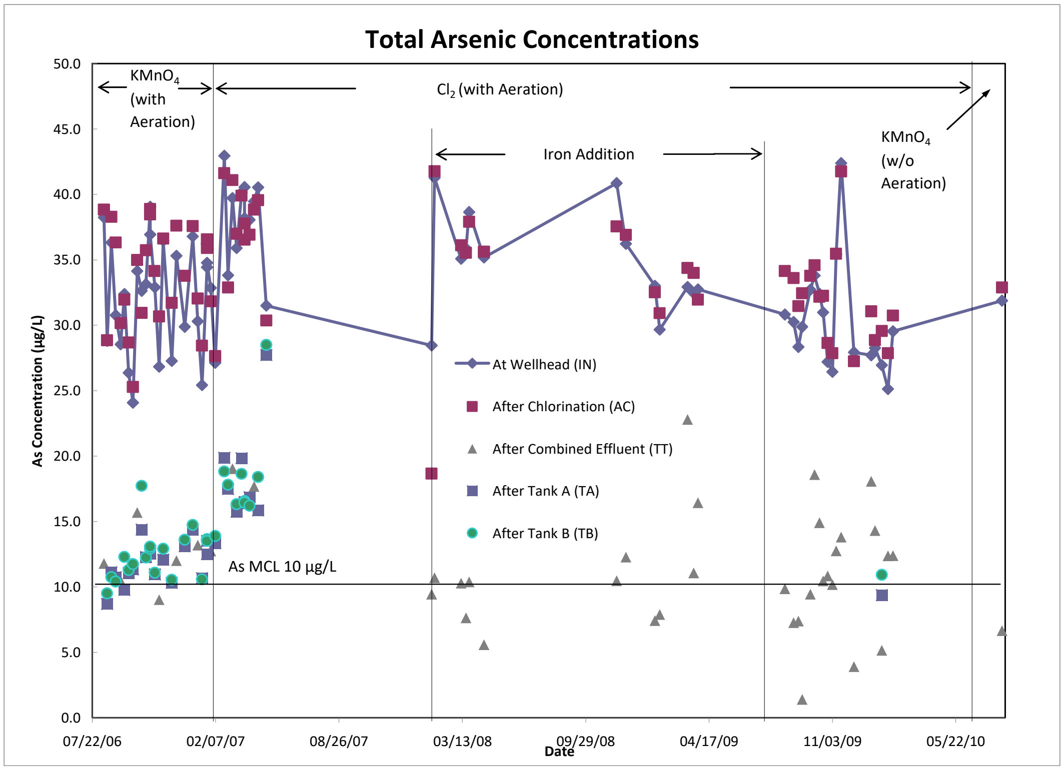


Figure 4-31. Total Arsenic Concentrations at IN, AC, TA, TB, and TT Sampling Locations

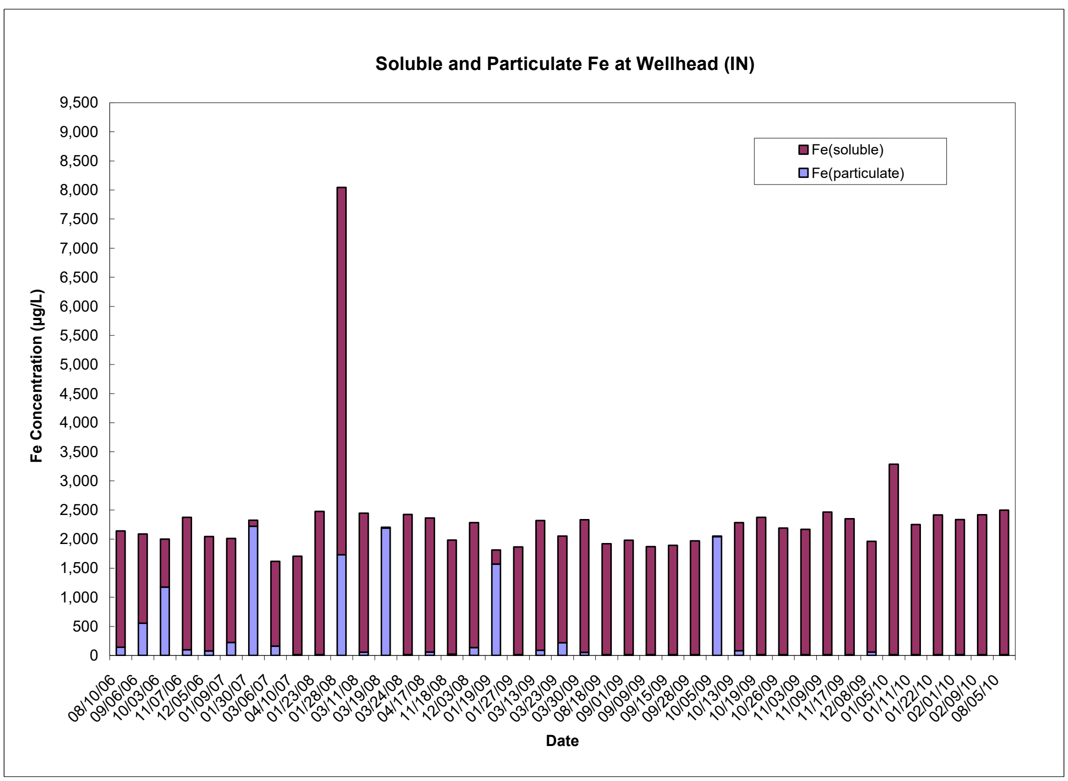
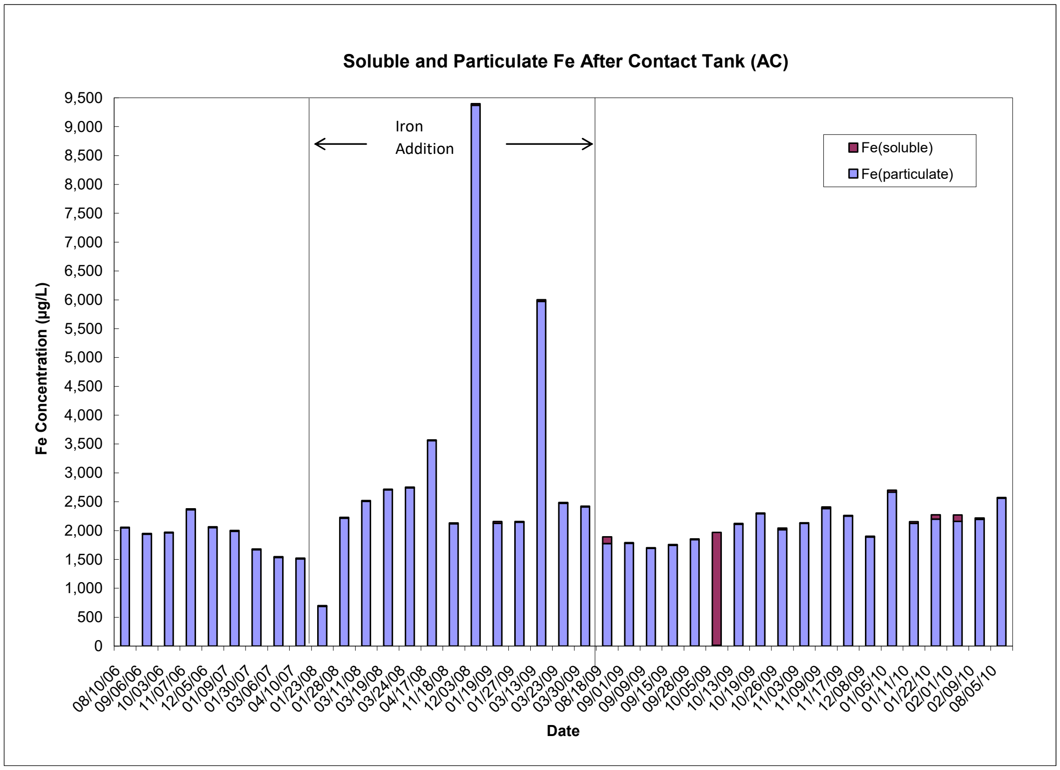


Figure 4-32. Soluble and Particulate Iron Across Treatment Train



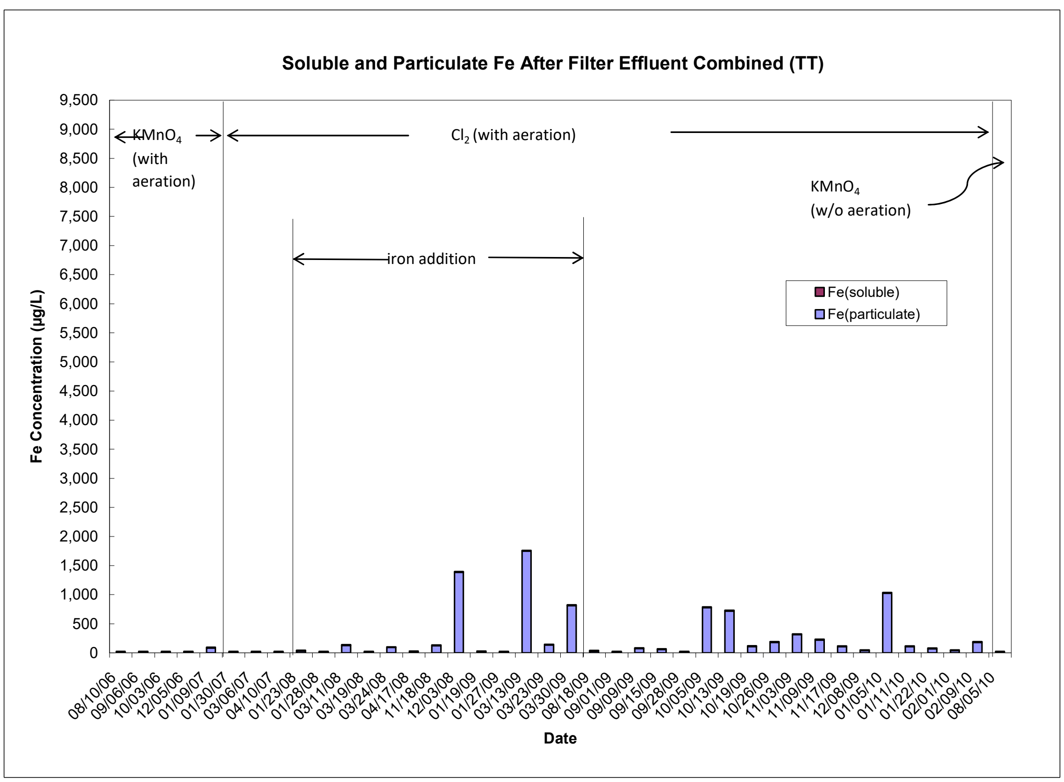


Figure 4-32. Soluble and Particulate Iron Across Treatment Train (Continued)

soluble iron in source water were at least 66 times (on average) the amounts of soluble arsenic. This soluble iron to soluble arsenic ratio was much higher than the 20:1 rule-of-thumb value needed for effective arsenic removal via adsorption/co-precipitation with iron solids. This is why it became suspicious that some soluble iron might, in fact, be precipitated via aeration, rendering it less effective in turning soluble As(V) into arsenic-laden solids. An unusually high iron concentration of 8,045 μg/L (with 6,314 μg/L existing in the soluble form) was measured on January 28, 2008 (see the first bar chart in Figure 4-32). It was not clear what caused this to occur. Out of the 41 speciation events, the ones on October 3, 2006, January 30, 2007, March 11, 2008, January 19, 2009, and October 5, 2009, had particulate iron as the predominant species. This most likely was caused by aeration during sampling.

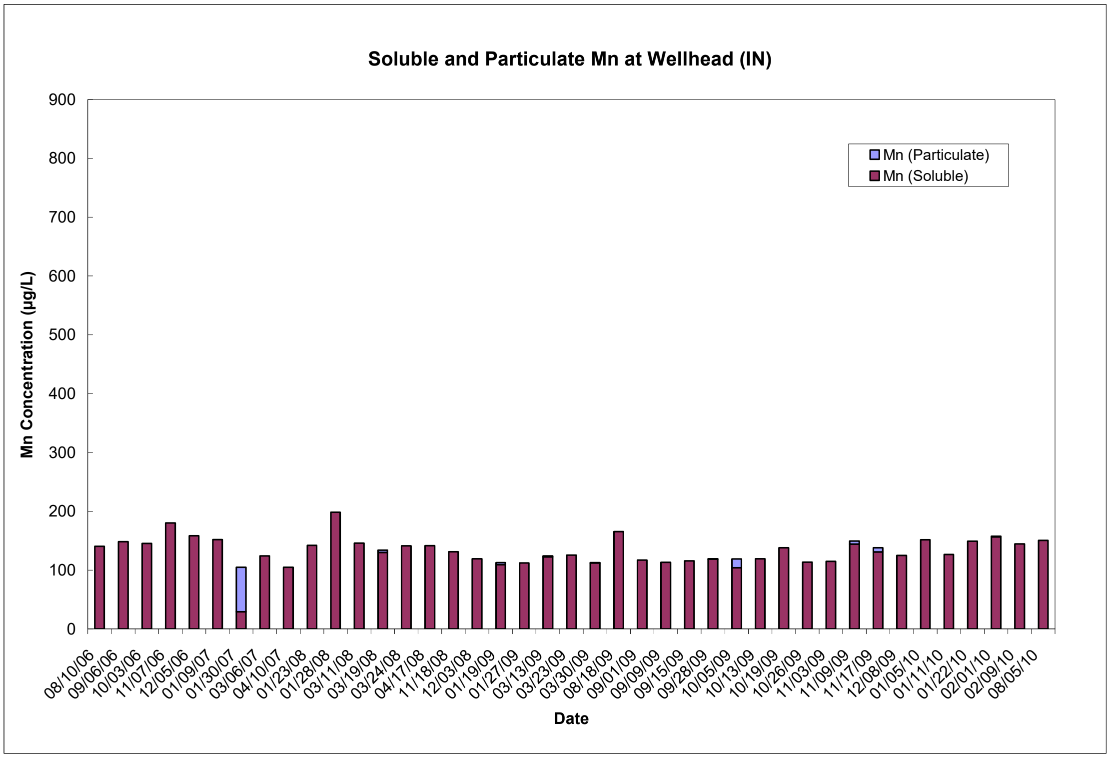
As expected, soluble iron was precipitated to become iron solids after oxidant addition/aeration in the aeralater (see the second bar chart in Figure 4-32). On October 5, 2009, iron at the AC location existed only as soluble iron. As discussed earlier, this most likely was caused by malfunctioning of the chlorine addition system.

With iron addition, total iron concentrations varied from 701 to 9,399 μg/L and averaged 3,173 μg/L, compared to 1,995 μg/L without iron addition. Increases in iron concentration occurred during three sampling events on April 17, 2008, December 3, 2008, and March 13, 2009. As discussed in Section 4.4.2, iron dosages were not well controlled because of the use of an over-sized pump and a corroding/dissolving impeller/mixer. Stratification of iron crystals in the chemical day tank very much could have been a source of errors contributing to the erratic results.

Iron leakage could be seen in the filter effluent as shown in the third bar chart in Figure 4-32. With iron addition, iron concentrations as high as 1,763 μg/L were measured (on March 13, 2009) in the filter effluent. Because of continuing aeration and iron addition, the Macrolite® filters became increasingly fouled and iron leakage became even more significant and frequent during the most of year 2009. This was the reason for the flow dropping even with three consecutive acid washes (although the washes were done with much less amounts of HCl than recommended by the vendor) in March, July and October 2009. Flowrates were "restored" only after rubber grommets in the flow restrictors were removed in October 2009. Iron addition discontinued in July 2009.

4.5.1.3 Manganese. Figure 4-33 presents three bar charts showing soluble and particulate manganese concentrations measured at the IN, AC, and TT locations. Total manganese concentrations in source water ranged from 96.2 to 196 μg/L and averaged 132 μg/L, existing almost entirely in the soluble form (see Tables 4-9 and 4-10). Due to $KMnO_4$ addition, manganese concentrations increased to as high as 787 μg/L at the AC location during the first six speciation events (and the seventh event apparently with the use of both $KMnO_4$ and gas chlorine). $KMnO_4$ reacted with reducing species in source water and formed a significant amount of manganese solids, presumably MnO_2, as shown by the blue bars in the second bar chart. After $KMnO_4$ was replaced with gas chlorine, manganese concentrations remained relatively unchanged. Chlorine was not effective in oxidizing soluble manganese, as shown by the mostly scarlet bars in the bar chart. Studies have found that incomplete oxidation of soluble Mn(II) occurs using free chlorine at pH values less than 8.5 (Knocke et al., 1987 and 1990; Condit and Chen, 2006; McCall et al., 2007).

Particulate manganese was removed by the pressure filters (see the third bar chart), leaving mostly soluble manganese in the filter effluent. Four of the first six speciation events showed elevated soluble manganese, probably caused by overdosing of $KMnO_4$ or formation of colloidal manganese particles due to the presence of TOC in source water.



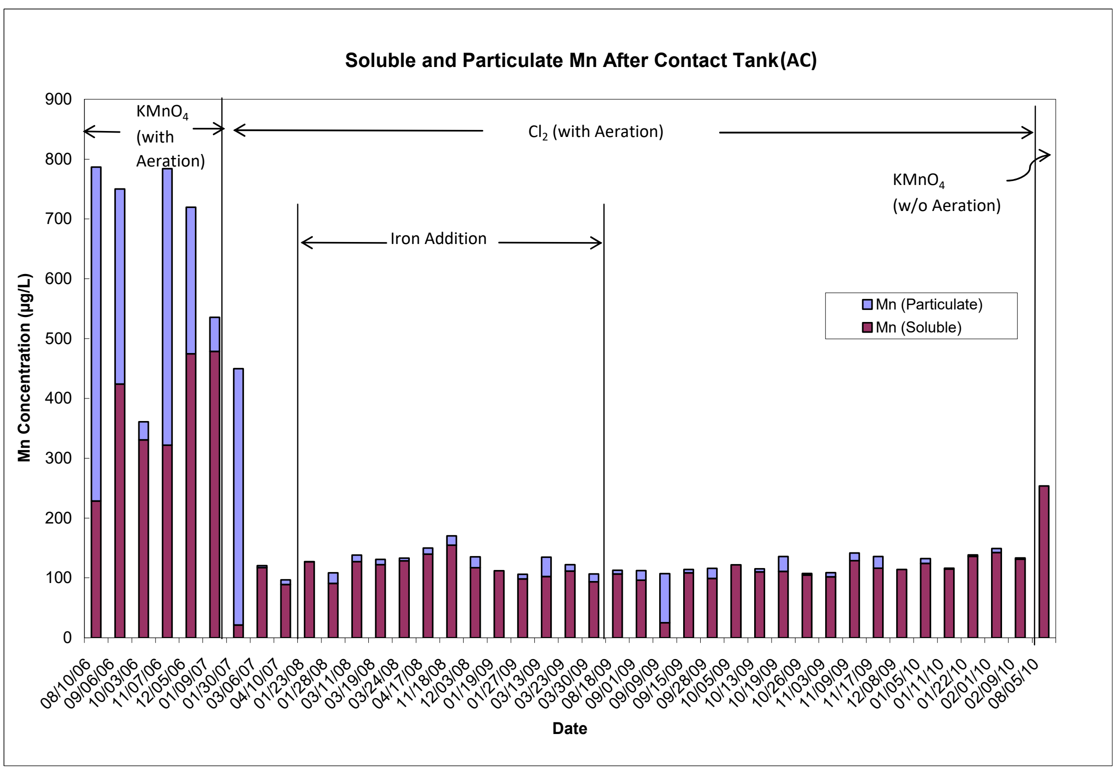


Figure 4-33. Soluble and Particulate Manganese Concentrations Across Treatment Train

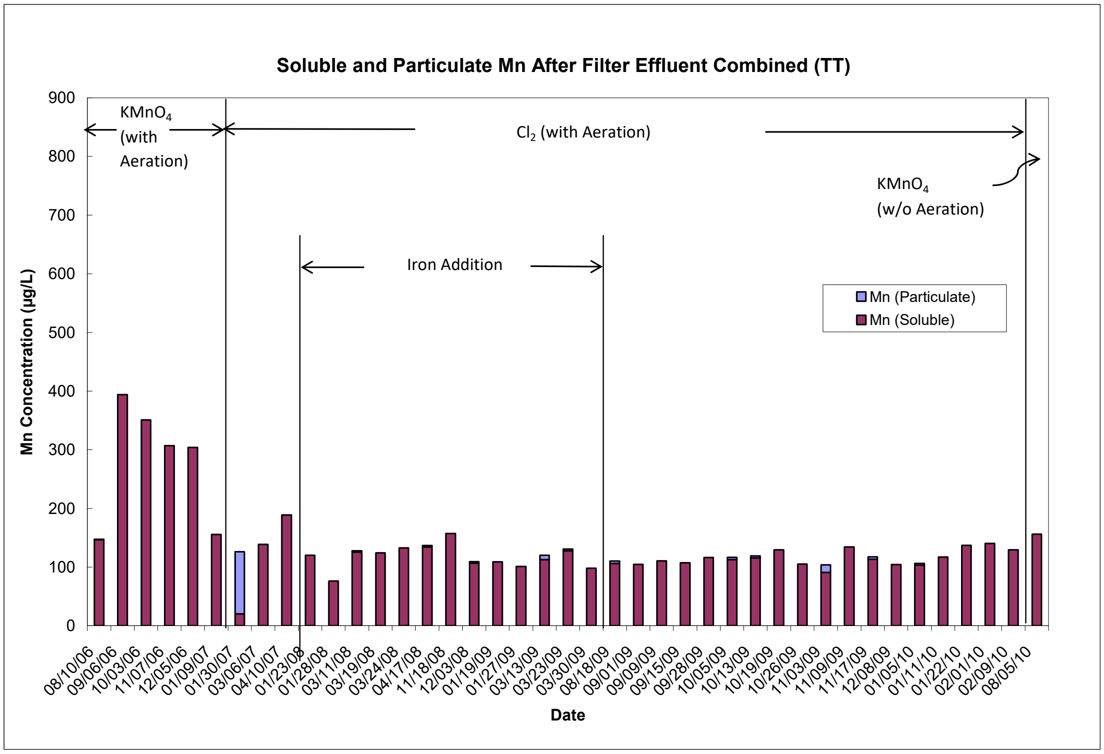


Figure 4-33. Soluble and Particulate Manganese Concentrations Across Treatment Train (Continued)

4.5.1.4 pH, DO, and ORP. pH, temperature, DO, and ORP were measured after system startup through April 17, 2007. Based on the data collected, pH values of source water ranged from 6.0 to 7.0 and averaged 6.8 (Table 4-9). This pH range was somewhat lower than that measured historically (see Table 4-1) and was ideal for arsenic adsorption onto iron solids. DO levels in source water ranged from 0.9 to 4.7 mg/L and averaged 2.8 mg/L. This average value was much higher than the DO levels measured during the first several sampling events, i.e., 1.5, 0.9, 2.2, and 1.7 mg/L on August 10, August 15, August 22, and August 29, 2006, respectively. Higher DO levels measured most likely were caused by aeration during sampling and measurements. Similar to DO, ORP readings taken during the first several events were much lower than the average value (266 mV) measured during the entire sampling period. For example, -2.7, -6.7, 6.1, 5.4, 3.1, and 5.7 mV were measured during the first six of seven sampling events. Aeration again was thought to be the main contributing factor for the high readings. Great caution must be taken during DO and ORP measurements, although the project team did experience frequent malfunctioning of DO probes and excessive drifting when taking ORP measurements at this and a large number of other arsenic demonstration sites.

After oxidant addition and the aeralater, the average pH value increased to 7.3 but remained constant across the pressure filters. DO levels increased significantly to an average of 5.5 mg/L, indicating aeration. After the blower in the aeralater were turned off, DO levels remained elevated at 2.4 to 3.4 mg/L, indicating continuing aeration (but at a lesser extent). As noted earlier, aeration might have adversely affected soluble As(V) removal by iron solids. No routine DO measurement was made after the aluminum trays had been removed and the standpipe in the aeralater was cut in July 2009. Therefore, the effect of this action was not clear. However, the DO measurements performed during the January 2010 special study indicated an elevated DO level of 2.4 mg/L at the AC location. After the aeralater was bypassed, the DO level was reduced to 0.5 mg/L. Results of this special study are discussed in detail in Section 4.5.2.2.

4.5.1.5 Ammonia and Nitrate. As shown in Table 4-9, ammonia concentrations ranged from 1.5 to 2.2 mg/L (as N) and averaged 1.9 mg/L (as N). Ammonia concentrations were reduced to 1.7 and 1.4 mg/L (as N) at the AC and TT locations, respectively. Nitrification and/or chlorination were primarily responsible for the concentration reduction. Before gas chlorine was used to replace $KMnO_4$ by the end of January 2007, nitrification was the only process consuming ammonia. Ammonia concentrations were reduced from 2.0 mg/L (as N), on average, at the wellhead to 1.8 mg/L (as N), on average, after the aeralater. After the pressure filters, its concentrations were further reduced to 0.9 mg/L (as N), on average.

With the blower on, nitrification was active seven weeks into system operation, as evidenced by a lower ammonia concentration, i.e., 1.3 mg/L (as N), in the filter effluent on August 10, 2006 (see Figure 4-34). Ammonia concentrations after the filters were further reduced to 1.1, 0.6. 0.5, and 0.8 mg/L (as N) by September 6, October 3, November 7, and December 5, 2006, respectively. This was when the backwash frequency increased to as many as eight times per day and an acid and a caustic wash were recommended by the vendor. At this point, nitrate concentrations had increased to 0.6 mg/L (as N). The increase in nitrate concentration, however, was less than the stoichiometric amount.

After the acid and caustic washes, biological activities apparently were under control, as reflected by the essentially "constant" level of ammonia (i.e., 1.5, 1.7, and 1.7 mg/L [as N]) and less than the MDL of nitrate (0.05 mg/L [as N]) across the treatment train. To curb biofouling, gas chlorine was used to replace $KMnO_4$ by the end of January 2007, and the blower was turned off by March 2007. From late January through April 30, 2007, when the routine sampling was temporarily discontinued, ammonia levels were reduced, on average, from 1.9 mg/L (as N) at the wellhead to 1.7 mg/L (as N) after the aeralater, and then to 1.4 mg/L (as N) after the filters. Assuming that the 0.2 mg/L (as N) of concentration reduction (from 1.9 down to 1.7 mg/L [as N]) was caused by chlorination, the 0.3-mg/L (as N) reduction across the filters could have been caused, again, by nitrification (note that 0.1 mg/L of nitrate [as N] was measured on April 10, 2007). The extent of nitrification, if any, definitely was much less significant than before.

After the aluminum tray was removed and standpipe was cut in July 2009, ammonia concentration reduction was observed only across the aeralater (i.e., from 2.0 mg/L [as N] at the wellhead to 1.7 mg/L [as N] after the aeralater), presumably caused by chlorination. Ammonia concentrations remained unchanged at 1.7 mg/L (as N) after the filters. Therefore, little or no nitrification would occur at this point. Nitrate concentrations measured in this study period were either less than the MDL or at 0.1 mg/L (as N).

4.5.1.6 Other Water Quality Parameters. Hardness, fluoride, sulfate, silica, TOC, and alkalinity levels remained constant across the treatment train and were not affected by the treatment process (Table 4-9). Phosphorus levels after the aeralater, which were slightly higher than the average raw water concentration of 648 μg/L (possibly due to trace quantities in the pretreatment chemicals), decreased to an average of 225 μg/L after the pressure filters (see discussion in Section 4.5.1). Turbidity also decreased significantly with treatment (i.e., from 25.1 NTU in source water to 0.7 NTU after the TT location).

4.5.2 Special Studies. Several special studies were conducted to attempt to improve system performance during the performance evaluation study. Results of these studies are discussed in detail below.

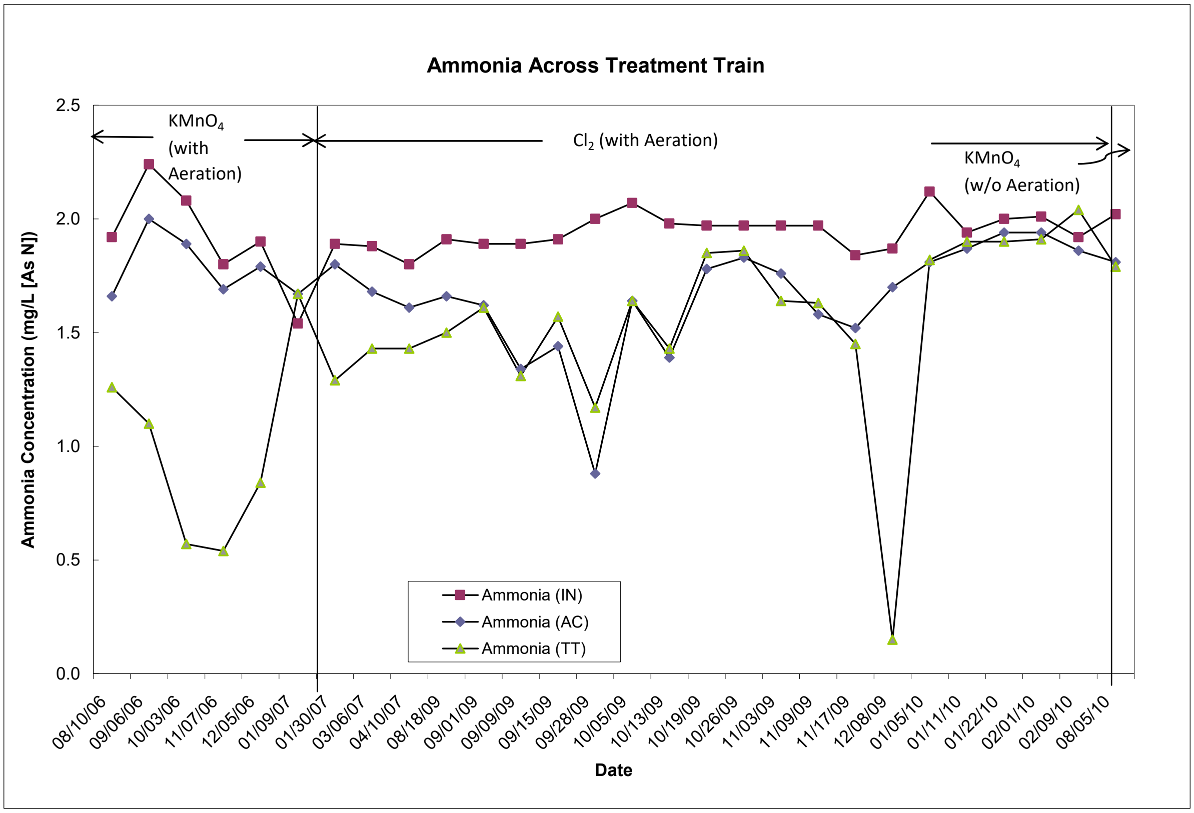


Figure 4-34. Ammonia Concentrations Across Treatment Train

4.5.2.1 Filter Run Length Studies. Three filter run length studies were performed. The first was conducted on November 19, 2007, before the implementation of supplemental iron addition. The test run was short (3.2 hr), with 11.4 to 12.9 µg/L of soluble arsenic but less than the MDL of particulate iron in the filter effluent.

After iron addition had begun, a second filter run length study was conducted on May 29, 2008. The results showed no As(III) oxidation nor arsenic-laden iron solids removal based on total and soluble arsenic and iron data, apparently caused by a problem with the chlorine addition system.

A repeat run length study was conducted on October 20, 2008, but the results indicated that iron dosage was too low due to an on-going problem with the mixing equipment, which continued to corrode and dissolve. No additional run length studies were attempted after the three rather unsuccessful tests.

4.5.2.2 Aeralater Bypass Test. Aeration in the aeralater might have caused ineffective soluble As(V) removal by iron solids using either $KMnO_4$ or chlorine. For the IR process to be effective, iron must be precipitated in the presence of soluble As(V), as this induces co-precipitation and/or adsorption of soluble As(V) and forms arsenic-laden iron particles prior to filtration. Although $KMnO_4$ or chlorine was added just before water entered the aeralater, soluble iron and soluble As(III) could still exist as water exited the standpipe. This might result in precipitation of soluble iron and contact of iron solids with soluble As(V) and soluble As(III), thus hindering the adsorption/co-precipitation process.

To verify the adverse effect of aeration, the aeralater was bypassed by diverting well water directly to the pressure filters after chlorination. Samples were taken at the AC sampling location for DO and arsenic speciation measurements. It was postulated that bypassing the aeralater would eliminate aeration, thus decreasing soluble As(V) concentrations and increasing particulate arsenic concentrations prior to the pressure filters. However, the presence of ammonia could skew the results due to formation of chloramines, which were less effective in oxidizing soluble As(III) and soluble Fe(II).

Table 4-11 compares results of the samples taken before and after aeralater bypass. As measured during the initial site visit on November 3, 2004 and the first several sampling events after system startup, source water was highly reducing, with an ORP reading of -42 mV and a DO concentration of 0.1 to 0.2 mg/L (note the method of source water sample collection in Section 3.4.2.1). Before aerator bypass, water taken at the AC location contained 2.4 mg/L of DO, indicating aeration despite removal of the aluminum trays and shortening of the standpipe. The ORP reading increased, as expected, to as high as 483.0 mV due to chlorination. About 0.9 mg/L of total chlorine (as Cl_2) was measured, presumably existing as chloramines. This level of total chlorine was acceptable for protection of the synthetic zeolite in the downstream softening unit.

Table 4-11. Results of Samples Taken Before and After Aeralater Bypass

Analytes	Unit	Sampling Locations					
		IN		AC		TT	
		Before	After	Before	After	Before	After
pH	S.U.	6.9	NA	7.1	6.9	7.2	NA
Temperature	°C	20.9	NA	20.8	20.3	20.8	NA
DO	mg/L	0.1	0.2	2.4	0.5	3.8	NA
ORP	mV	-42	-42.4	483	327	406	NA
Total Chlorine (as Cl_2)	mg/L	NA	NA	0.9	1.6	0.8	NA
NH_3 (as N)	mg/L	NA	NA	1.1	0.9	NA	NA
As (total)	µg/L	NA	NA	29.5	29.8	NA	NA
As (soluble)	µg/L	NA	NA	11.8	12.5	NA	NA
As (particulate)	µg/L	NA	NA	17.7	17.3	NA	NA
As(III)	µg/L	NA	NA	0.9	0.5	NA	NA
As(V)	µg/L	NA	NA	10.9	12.0	NA	NA
Fe (total)	µg/L	NA	NA	1,824	1,943	NA	NA
Fe (soluble)	µg/L	NA	NA	33.2	45.6	NA	NA
Mn (total)	µg/L	NA	NA	109	113	NA	NA
Mn (soluble)	µg/L	NA	NA	111	103	NA	NA

DO = dissolved oxygen; NA = not available; ORP = oxidation-reduction potential

Metals analyses for samples taken at the AC location before aerator bypass showed 29.5 µg/L of total arsenic with about one third (11.8 µg/L) present as soluble arsenic. Of the soluble arsenic fraction, most (10.9 µg/L) was present as As(V), similar to what had been observed during the entire study period. This soluble fraction was not removed by the filters and was in the filter effluent. As expected, manganese existed entirely in the soluble form.

After aeralater bypass, DO in water sampled from the AC location remained low (0.5 mg/L). Contrary to what would be anticipated, the low DO level did not result in a lower level of soluble arsenic or As(V) (which were measured at 12.5 and 12.0 µg/L, respectively). It was not clear if the formation of chloramines had played a role on these unexpected results. Additional examination on jar test results would be needed to verify these results.

4.5.2.3 Jar Tests. Tables 4-12 and 4-13 present results of optimal oxidant dose and arsenic and iron removal tests, respectively. Figure 4-35 shows arsenic speciation results obtained during the arsenic and iron removal tests. The use of 2.2 to 7.1 mg/L NaOCl (as Cl_2) left 0.8 to 3.9 mg/L (as Cl_2) of residual in glass jars after 20 min of contact time, indicating a demand of 1.4 to 3.2 mg/L (as Cl_2). The increasing chlorine demand was contrary to the assumption that a finite and consistent amount of reducing species existed in raw water. At higher chlorine doses, more chlorine may react with TOC in water, thus resulting in higher chlorine demands. However, reactions between chlorine and TOC may or may not result in lower TOC levels in the treated water.

To protect the downstream synthetic zeolite in the softening unit, the 2.2-mg/L (as Cl_2) dose was selected for the follow-on arsenic and iron removal jar test (because it resulted in a residual level below 1.0 mg/L [as Cl_2] as shown in Table 4-12). However, after 20 min of contact time, only 0.1 mg/L (as Cl_2) of residual was measured in the glass jar (see Table 4-13). This, in conjunction with the high levels of soluble arsenic (22.3 µg/L), soluble As(III) (4.8 µg/L), and soluble iron (730 µg/L), suggest that the 2.2-mg/L (as Cl_2) dose was not enough to react with all reducing species in the water tested. As shown in Table 4-13, more than 2.1 mg/L of total iron (existing entirely as soluble iron) was present in water collected for the NaOCl jar test and more than 2.6 mg/L of total iron present in water for the $KMnO_4$ jar tests (raw water quality not measured). Water quality apparently had changed during the 2-day study period, thus causing insufficient addition of chlorine during the jar test.

Table 4-12. Jar Test Results for Optimal Oxidant Doses

Oxidant	Dose (mg/L)	Contact Time (min)	Residual Oxidant (mg/L)	Oxidant Demand (mg/L)
NaOCl	0.0	20	0	NA
	2.2	20	0.8	1.4
	4.2	20	2.3	1.9
	7.1	20	3.9	3.2
$KMnO_4$	0.00	20	0.00	NA
	1.9	20	0.9	1.0
	4.2	20	2.8	1.4
	6.6	20	5.0	1.6

NA = not applicable

As shown in Table 4-13, TOC levels remained unchanged at 1.4 mg/L during the NaOCl jar test. Manganese levels also remained constant. Ammonia levels increased from 1.3 to 1.6 mg/L (as N). There is no plausible explanation for such an increase, and analytical errors may be the only probable cause. DO levels remained low at 1.0 mg/L (versus 0.9 mg/L in raw water); DO levels in the $KMnO_4$ jars also remained low at 1.1 to 1.2 mg/L. These, together with the presence of only soluble iron in raw water, suggest that the water collection method adequately preserved raw water quality during the study period.

The $KMnO_4$ demand study used 1.9, 4.2. and 6.6 mg/L of $KMnO_4$ (as $KMnO_4$) in three separate jars. As shown in Table 4-12, $KMnO_4$ residual levels ranged from 0.9 to 5.0 mg/L, reflecting a demand of 1.0 to 1.6 mg/L (as $KMnO_4$). This demand was somewhat lower than the amounts (from 1.6 to 2.2 mg/L) measured during the follow-on jar tests, probably because of the lower iron level in raw water (i.e., 2.1 versus 2.6 mg/L). In the presence of ammonia, $KMnO_4$ is a stronger and more effective oxidant than NaOCl because NaOCl reacts with ammonia to form chloramines.

Table 4-13. Jar Test Results for Arsenic and Iron Removal

Analytes	Unit	Oxidant Dosage					
		NaOCl		$KMnO_4$			
		0	2.2	0	1.9	4.2	6.6
Contact Time		20	20	NM	20	20	20
pH	S.U.	7.4	7.0	NM	7.0	7.1	7.1
Temperature	ºC	19.5	19.5	NM	19.6	19.8	19.9
DO	mg/L	0.9	1.0	NM	1.2	1.2	1.1
ORP	mV	-42	63	NM	237	373	463
Residual Oxidant	mg/L	0	0.1	NM	0.3	2.4	4.4
Oxidant Demand	mg/L	NA	>2.1	NM	1.6	1.7	2.2
NH_3 (as N)	mg/L	1.3	1.6	NM	1.2	1.2	1.1
TOC	mg/L	1.4	1.4	NM	1.4	1.2	1.1
As (total)	µg/L	29.9	30.7	NM	31.0	28.1	29.1
As (soluble)	µg/L	30.8	22.3	NM	7.4	6.2	6.6
As (particulate)	µg/L	0.0	8.4	NM	23.6	21.9	22.5
As(III)	µg/L	29.7	4.8	NM	1.5	0.7	0.9
As(V)	µg/L	1.1	17.5	NM	5.9	5.5	5.7
Fe (total)	µg/L	2,117	2,150	NM	2,677	2,654	2,663
Fe(soluble)	µg/L	2,111	730	NM	<25	<25	<25
Mn (total)	µg/L	121	122	NM	951	1,926	2,746
Mn (soluble)	µg/L	126	123	NM	178	426	1,133

DO = dissolved oxygen; NA = not available; NM = not measured; ORP = oxidation-reduction potential; TOC = total organic carbon

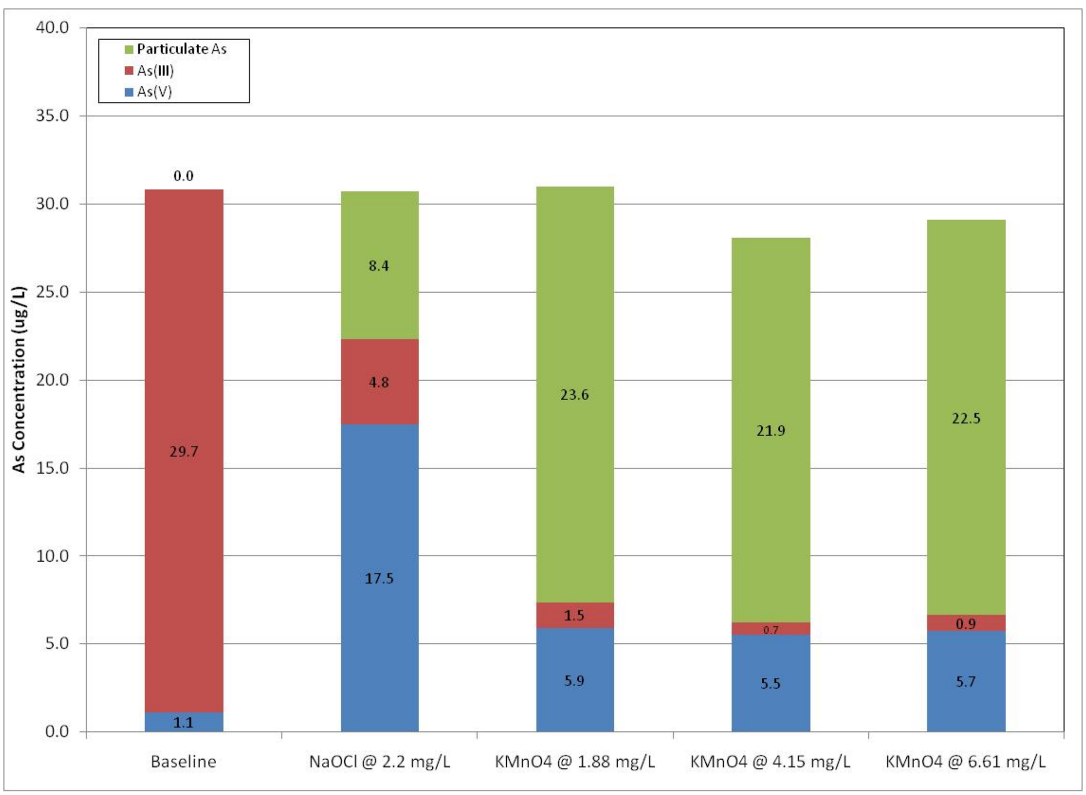


Figure 4-35. Arsenic Speciation Results for Samples Collected During Jar Tests

After 20 min of contact time, $KMnO_4$ reduced soluble arsenic, soluble As(III), and soluble As(V) to levels below 7.4, 1.5, and 5.9 μg/L, respectively. Soluble iron was converted in its entirety to arsenic-laden iron solids, which can be removed by the Macrolite filters. As expected, ammonia concentrations remained constant at 1.1 to 1.2 mg/L, since it does not react with $KMnO_4$. TOC levels were reduced somewhat, from 1.4 to 1.1 mg/L, as the $KMnO_4$ dosage increased from 1.9 to 6.6 mg/L.

Two key issues related to the use of $KMnO_4$ involved selecting and maintaining an initial dose and coping with changing water quality. With 2.6 mg/L of iron, 1.5 mg/L of $KMnO_4$ (as $KMnO_4$) would be recommended, assuming that raw water would bypass the aeralater. Because TOC levels in raw water were marginally elevated, the need to increase $KMnO_4$ dose to "overcome" the TOC effect, as discussed in Section 2.3, might not exist. Also, overdosing $KMnO_4$ would impart pink color to and elevated manganese levels in the filter effluent. Any untreated soluble Mn(II) might be removed by the downstream synthetic zeolite.

4.5.2.4 Filter Run Length Study During January 2010 Site Visit. Figure 4-36 shows a time-series plot of arsenic, iron, and manganese breakthrough from Tank A, along with flowrate (Q) and Δp data shown next to the iron data points. Also present on the plot are horizontal lines indicating the arsenic MCL (10 μg/L), manganese SMCL (50 μg/L), and iron SMCL (300 μg/L).

Total arsenic was measured at 14.8 μg/L before the first hour of filter runtime, with most of the concentration (13.1 μg/L) present in the soluble form. Total arsenic concentrations decreased slightly over the next 5 hr, with concentrations ranging from 11.6 to 12.4 μg/L. Particulate arsenic concentrations remained relatively constant and ranged from 1.1 to 2.2 μg/L. The quick breakthrough was obviously caused by the fact that arsenic existed primarily in the soluble form before entering the filters.

Total iron was measured at 270 μg/L after the first hour of filter runtime. In contrast to the breakthrough of arsenic, almost all of the iron was in the particulate form. Total manganese was measured above the SMCL of 50 μg/L after the first hour of filter runtime. This was to be expected, as all of the manganese present after chlorination was in the soluble form. Manganese measured throughout the run-length study ranged from 116 to 121 μg/L, all of which was present in the soluble form.

The poor filter performance was expected because most arsenic that broke through from the filters existed as soluble arsenic and because iron particles prematurely broke through the filter beds most likely due to bio- and iron fouling of the filter media and shallow bed depths of the filters. The result of this run length study was consistent with what was observed during the performance evaluation study.

4.5.3 Backwash Wastewater Sampling. Table 4-14 presents analytical results of six backwash wastewater sampling events taking place prior to implementation of iron addition. Concentrations of TDS and total suspended solids (TSS) ranged from 326 to 474 mg/L and from 18 to 234 mg/L, respectively. Concentrations of total arsenic, iron, and manganese ranged from 110 to 468 μg/L, from 13.8 to 74.0 mg/L, and from 592 to 3,689 μg/L, respectively. As expected, these metals existed primarily in the particulate form. Average concentrations of particulate arsenic, iron, and manganese were 218 μg/L, 31.8 mg/L, and 1,464 μg/L, respectively. Assuming that these average particulate results existed during the production of 6,752 gal of wastewater per backwash event, approximately 0.01 lb of arsenic, 1.8 lb of iron, and 0.08 lb of manganese would be disharged during each backwash event. Using the average TSS concentration (87.8 mg/L), the total amount of solids discharged would be 4.9 lb. For all events, the backwash wastewater had a pH of 7.8 to 8.0.

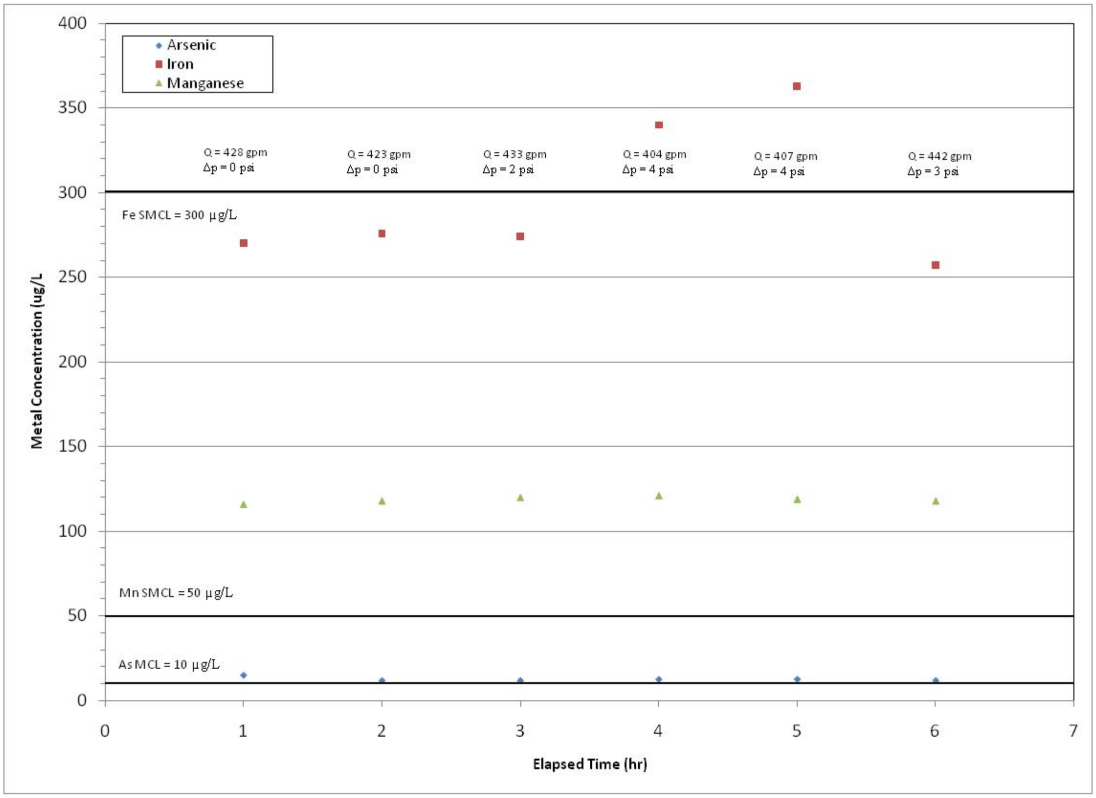


Figure 4-36. Arsenic, Iron, and Manganese Breakthrough During Filter Run-length Study

4.5.4 Distribution System Water Sampling. Table 4-15 summarizes the results of the distribution system sampling events. The water quality was similar among the three residences except for copper at the DS1 and DS3 residences, which exhibited higher concentrations than the other residence. After the treatment system began operation, arsenic concentrations remained essentially unchanged from the average baseline level of 15.6 µg/L to 15.3 µg/L. Iron and manganese concentrations increased slightly from baseline levels of <25 and 65.3 µg/L to 47.2 and 96 µg/L, respectively. Alkalinity, pH, and lead concentrations also increased slightly from average baseline levels of 296 mg/L (as $CaCO_3$), 7.1 S.U., and 0.4 µg/L to 333 mg/L (as $CaCO_3$), 7.4 S.U., and 0.8 µg/L, respectively. Copper concentrations increased rather significantly from the average baseline level of 108 µg/L to 267 µg/L, due mainly to four >1,000 µg/L hits, including one over the 1,300-µg/L action level (1,317 µg/L). Otherwise, the water in the distribution system was comparable to that of the treatment system effluent. Thus, the treatment system appeared to have no beneficial effects on arsenic, manganese, and iron concentrations of the distribution system water.

4.6 System Cost

The system cost was evaluated based on the capital cost per gpm (or gpd) of design capacity and the O&M cost per 1,000 gal of water treated. Capital cost of the treatment system included cost for equipment, site engineering, and system installation, shakedown, and startup. O&M cost included cost for chemicals, electricity, and labor. Cost associated with the building including the sump, sanitary sewer connections, and water system telemetry was not included in the capital cost because it was not included in the scope of this demonstration project and was funded separately by United Water Systems.

Table 4-14. Backwash Wastewater Sampling Test Results

Sampling Event		BW1 Vessel A										BW2 Vessel B									
		pH	TDS	TSS	As (total)	As (soluble)	As (particulate)	Fe (total)	Fe (soluble)	Mn (total)	Mn (soluble)	pH	TDS	TSS	As (total)	As (soluble)	As (particulate)	Fe (total)	Fe (soluble)	Mn (total)	Mn (soluble)
No.	Date	S.U.	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	S.U.	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1	09/19/06	7.5	470	56	110	17.5	72.5	14,232	33.8	1,312	119	7.4	474	48	114	18.9	95.5	14,373	56.7	1,222	134
2	10/31/06	7.2	392	65	165	13.0	152	19,391	54.7	3,689	126	7.3	410	50	128	13.6	114	13,779	81.2	2,732	145
3	01/15/07	7.5	360	45	213	16.4	197	28,167	59.9	1,334	32.1	7.4	374	18	224	15.6	208	29,562	68.4	1,446	86.5
4	02/14/07	7.6	360	32	137	24.6	113	15,439	52.3	592	58.8	7.5	362	102	225	28.3	197	26,083	22.8	896	52.0
5	02/26/07	7.7	340	136	279	19.8	259	35,973	<25	956	87.8	7.8	326	113	418	19.0	399	59,262	<25	1,308	95.4
6	03/25/07	7.5	392	234	468	14.8	453	73,957	<25	1,965	86.9	7.5	400	154	348	14.8	363	51,976	<25	1,222	88.1

TDS = total dissolved solids; TSS = total suspended solids

Table 4-15. Distribution System Sampling Results

	Address	DS1								DS2								DS3							
	Sample Type	LCR								LCR								LCR							
	Flushed/ 1st Draw	1st Draw								1st Draw								1st Draw							
No. of Sampling Events	Sampling Date	Stagnation Time (hr)	pH (S.U.)	Alkalinity (mg/L as $CaCO_3$)	As (µg/L)	Fe (µg/L)	Mn (µg/L)	Pb (µg/L)	Cu (µg/L)	Stagnation Time (hr)	pH (S.U.)	Alkalinity (mg/L as $CaCO_3$)	As (µg/L)	Fe (µg/L)	Mn (µg/L)	Pb (µg/L)	Cu (µg/L)	Stagnation Time (hr)	pH (S.U.)	Alkalinity (mg/L as $CaCO_3$)	As (µg/L)	Fe (µg/L)	Mn (µg/L)	Pb (µg/L)	Cu (µg/L)
BL1	08/03/05[a]	6.2	7.1	295	20.1	<25	74.1	0.2	123	10.3	7.1	299	18.3	<25	78.2	0.8	161	8.0	7.0	295	18.6	<25	79.5	0.2	150
BL2	10/05/05	7.3	6.7	308	13.1	<25	68.3	<0.1	37.7	NA	7.1	308	12.9	<25	68.1	0.7	285	6.1	7.2	330	12.6	<25	70.4	0.4	279
BL3	11/30/05	7.8	7.0	286	15.3	<25	60.9	0.7	9.6	8.0	7.0	286	16.2	<25	52.4	0.3	123	0.0[b]	7.1	290	14.6	<25	53.6	0.5	13.3
BL4	01/31/06	NA	7.3	286	15.8	<25	68.1	0.4	36.2	NA	7.3	286	15.7	<25	52.5	0.6	38.2	NA	7.3	286	14.5	<25	57.7	0.2	33.9
1	09/11/06[c]	NS	NS	NS	NS	NS	NS	NS	NS	10.5	7.4	344	11.3	<25	214	1.9	268	12.0	7.3	333	12.2	<25	235	0.3	22.5
2	10/04/06	NA	7.2	323	20.7	<25	123	0.2	34.8	NA	7.2	323	20.7	<25	135	<0.1	21.1	0.2	7.2	325	20.7	<25	125	<0.1	5.0
3	11/15/06	7.5	7.2	318	8.1	<25	52.0	0.1	21.2	NA	7.2	330	11.9	<25	101	1.7	32.4	8.0	7.2	320	8.9	<25	76.2	1.3	1,317
4	01/03/07	7.0	7.5	357	14.0	<25	133	<0.1	17.6	NA	7.6	351	16.1	43.2	105	3.1	33.6	9.0	7.6	361	13.5	<25	159	1.2	1,250
5	01/24/07	7.5	7.5	328	17.6	<25	54.8	<0.1	44.7	NA	7.4	322	21.4	<25	47.8	0.4	16.1	8.0	7.4	335	18.4	<25	53.3	0.2	331
6	02/08/07	6.5	7.6	352	16.5	<25	67.2	0.1	13.3	NA	7.5	340	19.1	658	161	1.3	21.1	6.5	7.6	332	15.6	38.0	70.3	1.3	174
7	03/13/07	7.0	7.4	328	13.8	<25	67.0	<0.1	74.4	NA	7.4	333	14.2	<25	51.4	1.4	25.2	NA	7.5	338	12.5	<25	71.4	1.0	1,071
8	04/03/07	6.0	7.5	320	12.9	<25	39.8	1.3	1,286	9.4	7.4	323	15.9	109	33.0	1.8	35.7	8.0	7.36	325	16.9	<25	34.0	0.1	21.0

(a) DS1, DS2, and DS3 samples switched for this sampling event; correct results displayed in table.
(b) No time lapsed.
(c) DS3 sample collected on 9/12/06 at 1026 another location on LCR sampling network.
BL = baseline sampling; NA = not available; NS = not sampled
Lead action level = 15 µg/L; copper action level = 1.3 mg/L

4.6.1 Capital Cost. The capital investment for the FM-284-AS system was $427,407 (Table 4-16). The equipment cost was $281,048 (or 66% of the total capital investment), which included cost for two, 84-in × 96-in steel pressure vessels and associated distributors, 150 ft^3 of Macrolite® media, process valves and piping, air scour system, chemical feed, instrumentation and controls, turbidimeter, and additional sample taps and totalizer/meters, shipping, labor, and system warranty. The system warranty covered the cost for repair and replacement of defective system components and installation workmanship for 12 months after system startup.

Table 4-16. Capital Investment for Kinetico's FM-284-AS System

Description	Cost	% of Capital Investment Cost
Equipment		
Welded Stainless Steel Frame	$13,951	–
84-in × 96-in Steel Pressure Vessels	$59,579	
Wedge Wire Distributors – 84 in Vessels	$16,543	
Macrolite® Media (150 ft^3)	$37,500	–
Process Valves and Piping	$47,797	
Air Scour System	$9,830	–
Chemical Feed System	$6,750	–
Instrumentation and Controls	$18,556	–
Turbidimeter	$6,612	
Additional Sample Taps and Totalizers/Meters	$1,700	–
Labor	$54,824	–
Freight	$7,406	–
Equipment Total	**$281,048**	**66%**
Engineering		
Labor	$44,520	–
Subcontractor	$6,250	–
Engineering Total	**$50,770**	**12%**
Installation, Shakedown, and Startup		
Labor	$90,804	–
Subcontractor	$0	–
Travel	$4,785	–
Installation, Shakedown, and Startup	**$95,589**	**22%**
Total Capital Investment	**$427,407**	**100%**

The site engineering cost covered the cost for preparing the required permit application submittal, including a process design report, a general arrangement drawing, piping and instrumentation diagrams, electrical diagrams, interconnecting piping layouts, tank fill details, and a schematic of the PLC panel, and obtaining the required permit approval from LADHH/OPH. The engineering cost of $50,770 was 12% of the total capital investment.

The installation, shakedown, and startup cost covered the labor and materials required to unload, install, and test the system for proper operation. All activities were performed by the vendor with the operator's assistance. The installation, startup, and shakedown cost of $95,589 was 22% of the total capital investment.

The total capital cost of $427,407 was normalized to $555/gpm ($0.38/gpd) of design capacity using the system's rated capacity of 770 gpm (or 1,108,800 gpd). The total capital cost also was converted to an annualized cost of $40,343 gal/yr using a capital recovery factor (CRF) of 0.09439 based on a 7% interest rate and a 20-yr return period. Assuming that the system operated 24 hr/day, 7 day/week at the design flowrate of 770 gpm to produce 404,712,000 gal/yr, the unit capital cost would be $0.10/1,000 gal. During the four-year study period, the system average daily demand was 277,128 gal, or 101,151,720 gal annually, so the unit capital cost increased to $0.40/1,000 gal.

A 53 ft × 25 ft pre-engineered metal building with a roof height of 16 ft was installed by United Water Systems to house the treatment system (Section 4.3.2). The cost of the building and supporting utilities was not included in the capital investment.

4.6.2 O&M Cost. O&M costs included chemical usage, electricity consumption, and labor as shown in Table 4-17. Three chemicals were used for treatment, including chlorine, $KMnO_4$, and $FeCl_3$. Since chlorination already existed prior to the demonstration study, its incremental cost for pre- and/or post-treatment was not tracked during the study. Addition of $FeCl_3$ was implemented from December 2007 through July 2009. However, the effect of iron addition was inconclusive due to erratic $FeCl_3$ dosage and aeration in the aeralater; the addition was terminated in July 2009. Thus, there was no need to include $FeCl_3$ addition in the cost analysis. $KMnO_4$ had been used since system startup through the end of January 2007 and its use resumed after the aeralater was bypassed in April 2010. Based on the average $KMnO_4$ dosage of 1.8 mg/L used in the study and a unit cost of $1.98/lb, the $KMnO_4$ usage was estimated to be $0.03/1,000 gal.

Table 4-17. O&M Costs for Kinetico's FM-284-AS System

Category	Value	Remarks
Annual Volume Processed (gal × 10^6)	101	Based on daily demand of 277,128 gal for study period from 07/17/06 through 09/16/10
Chemical Usage		
Chlorine Cost ($/1,000 gal)	NA	Existed prior to the demonstration study
$FeCl_3$ Cost ($/1,000 gal)	NA	Inconclusive; terminated in July 2009
$KMnO_4$ Consumption (lb/1,000 gal)	0.015	Based on an average dosage of 1.8 mg/L
Chemical Cost ($/1,000 gal)	0.03	Based on a unit cost of $1.98/lb
Electricity Consumption		
Electricity Cost ($/1,000 gal)	Negligible	
Labor		
Labor (hr/week)	2.5	30 min/day, 5 day/week
Labor Cost ($/1,000 gal)	$0.04	Labor rate = $30/hr
Total O&M Cost ($/1,000 gal)	$0.07	

Electrical power consumption associated with the chemical feed system was assumed to be negligible. The routine, non-demonstration related labor activities consumed 30 min/day, five days a week. Based on this time commitment and a labor rate of $30/hr, the labor cost was $0.04/1,000 gal of water treated. In sum, the total O&M cost was estimated to be $0.07/1,000 gal. It should be noted that this low O&M cost did not include any costs associated with the extensive system troubleshooting by the operator, such as performing the acid/caustic wash of the fouled media, replenishing the Macrolite® media, and modifying the existing aeralater piping configuration.

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APPENDIX A

OPERATIONAL DATA

Table A-1. US EPA Arsenic Demonstration Project at Arnaudville, LA - Daily System Operation Log Sheet

Week No.	Day of Week	Date	Time	Tank A Hour Meter hrs	Tank B Hour Meter hrs	TA Run Time hrs	TB Run Time hrs	$KMnO_4$ Tank 1 Level[(a)] inches	$KMnO_4$ Tank 2 Level (Iron) inches	Estimated $KMnO_4$ Dosage µg/L as Mn	Pressure Filtration: Influent psig	Outlet Tank A psig	Outlet Tank B psig	Effluent psig	Inlet-TA psig	Inlet-TB psig	Inlet-Effluent psig	Flow rate gpm	Totalizer to Distribution kgal	Gallon Usage gal	Daily Average Flowrate gpm	Backwash: Tank A No.	Tank B No.	Total Volume kgal	Daily Volume kgal	Since Last BW: Run Time Tank A hrs	Run Time Tank B hrs	Standby Time Tank A hrs	Standby Time Tank B hrs
0	Mon	07/17/06	7:33 AM	279.3	NR	NA	NA	NR	NR	NA	34	25	24	20	9	10	14	377	179.9	NA	NA	NR	NR	NR	NA	3.7	NR	5.9	NR
	Tue	07/18/06	10:23 AM	293.4	NR	14.1	NA	NR	NR	NA	35	19	19	19	16	16	16	340	467.7	287,800	#VALUE!	NR	NR	NR	NA	8.3	NR	9.0	NR
	Wed	07/19/06	8:30 AM	NR	NR	NA	NA	NR	NR	NA	34	NR	NR	NR	NA	NA	NA	430	NR	NA	#VALUE!	NR	NR	NR	NA	0.3	NR	0.4	NR
	Thu	07/20/06	7:50 AM	315.4	NR	22.0	NA	NR	NR	NA	34	25	24	23	9	10	11	370	976.6	508,900	#VALUE!	NR	NR	NR	NA	3.9	NR	6.5	NR
	Fri	07/21/06	7:03 AM	325.2	NR	9.8	NA	NR	NR	NA	35	22	21	19	13	14	16	346	1,198.9	222,300	#VALUE!	NR	NR	NR	NA	5.7	NR	7.8	NR
	Sat	07/22/06	7:49 AM	337.2	NR	12.0	NA	NR	NR	NA	33	25	24	20	8	9	13	389	1,474.9	276,000	#VALUE!	NR	NR	NR	NA	2.8	NR	6.3	NR
	Sun	07/23/06	9:47 AM	351.2	NR	14.0	NA	NR	NR	NA	37	0	28	18	NA	9	19	296	1,785.2	310,300	#VALUE!	NR	NR	NR	NA	0.3	NR	0.0	NR
0	Mon	07/24/06	NR	NR	NR	NA	NA	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	NR	NA	#VALUE!	NR	NR	NR	NA	NR	NR	NR	NR
	Tue	07/25/06	8:00 AM	374.4	NR	23.2	NA	NR	NR	NA	36	20	21	23	16	15	13	332	2,311.5	526,300	#VALUE!	NR	NR	NR	NA	6.3	NR	6.0	NR
	Wed	07/26/06	10:00 AM	386.7	NR	12.3	NA	NR	NR	NA	32	22	23	22	10	9	10	400	2,593.6	282,100	#VALUE!	NR	NR	NR	NA	2.6	NR	0.9	NR
	Thu	07/27/06	9:00 AM	396.6	NR	9.9	NA	NR	NR	NA	36	26	27	26	10	9	10	340	2,815.8	222,200	#VALUE!	NR	NR	NR	NA	4.4	NR	6.5	NR
	Fri	07/28/06	9:00 AM	410.4	NR	13.8	NA	NR	NR	NA	35	19	19	20	16	16	15	340	3,077.1	261,300	#VALUE!	NR	NR	NR	NA	8.2	NR	6.0	NR
	Sat	07/29/06	7:30 AM	419.9	NR	9.5	NA	NR	NR	NA	35	19	20	20	16	15	15	355	10,016.7	NA	#VALUE!	NR	NR	NR	NA	7.1	NR	9.0	NR
	Sun	07/30/06	7:30 AM	433.9	NR	14.0	NA	NR	NR	NA	32	22	23	22	10	9	10	390	10,291.8	275,100	#VALUE!	NR	NR	NR	NA	NR	NR	NR	NR
0	Mon	07/31/06	7:10 AM	446.0	NR	12.1	NA	NR	NR	NA	34	22	22	22	12	12	12	362	10,569.0	277,200	#VALUE!	NR	NR	NR	NA	5.3	NR	6.5	NR
	Tue	08/01/06	7:20 AM	458.3	NR	12.3	NA	NR	NR	NA	38	23	22	23	15	16	15	285	10,832.4	263,400	#VALUE!	NR	NR	NR	NA	8.2	NR	8.0	NR
	Wed	08/02/06	7:26 AM	469.5	NR	11.2	NA	NR	NR	NA	33	26	26	21	7	7	12	375	11,079.9	247,500	#VALUE!	NR	NR	NR	NA	1.5	NR	0.0	NR
	Thu	08/03/06	7:27 AM	481.7	NR	12.2	NA	NR	NR	NA	35	22	21	20	13	14	15	340	11,350.5	270,600	#VALUE!	NR	NR	NR	NA	5.2	NR	5.7	NR
	Fri	08/04/06	7:55 AM	494.2	NR	12.5	NA	NR	NR	NA	30	24	22	20	6	8	10	412	11,621.2	270,700	#VALUE!	NR	NR	NR	NA	0.1	NR	0.0	NR
	Sat	08/05/06	8:40 AM	506.7	NR	12.5	NA	NR	NR	NA	34	22	21	21	12	13	13	356	11,898.6	277,400	#VALUE!	NR	NR	NR	NA	5.2	NR	7.2	NR
	Sun	08/06/06	9:30 AM	519.3	NR	12.6	NA	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	420	12,178.9	280,300	#VALUE!	NR	NR	NR	NA	1.9	NR	0.2	NR
1	Mon	08/07/06	7:20 AM	529.7	NR	10.4	NA	NR	NR	NA	34	23	22	21	11	12	13	370	12,408.9	230,000	#VALUE!	NR	NR	NR	NA	2.8	NR	5.6	NR
	Tue	08/08/06	7:30 AM	541.5	NR	11.8	NA	NR	NR	NA	36	22	21	21	14	15	15	331	12,653.0	244,100	#VALUE!	NR	NR	NR	NA	6.7	NR	7.8	NR
	Wed	08/09/06	7:20 AM	554.2	NR	12.7	NA	NR	NR	NA	33	25	23	22	8	10	11	380	12,932.0	279,000	#VALUE!	NR	NR	NR	NA	1.8	NR	1.1	NR
	Thu	08/10/06	11:46 AM	569.1	570.4	14.9	NA	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	13,256.2	324,200	#VALUE!	68	68	556.4	NA	0.8	1.4	0.4	0.4
	Fri	08/11/06	7:33 AM	578.6	579.8	9.5	9.4	NR	NR	NA	36	26	26	19	10	10	17	330	20,183.9	NA	#VALUE!	69	69	564.3	7.9	3.0	3.0	3.7	4.4
	Sat	08/12/06	9:00 AM	590.5	591.6	11.9	11.8	NR	NR	NA	37	20	19	12	17	18	25	325	20,441.2	257,300	362	70	70	572.6	8.3	6.6	7.2	8.4	8.1
	Sun	08/13/06	10:46 AM	604.1	605.2	13.6	13.6	NR	NR	NA	34	21	22	14	13	12	20	344	20,736.7	295,500	362	72	72	604.1	31.5	4.0	3.4	5.0	4.9
2	Mon	08/14/06	7:03 AM	614.4	616.0	10.3	10.8	NR	NR	NA	37	19	20	11	18	17	26	323	20,963.0	226,300	358	73	73	614.9	10.8	6.3	5.8	6.0	6
	Tue	08/15/06	7:04 AM	631.6	624.8	17.2	8.8	NR	NR	NA	37	28	55	10	9	NA	27	305	21,285.3	322,300	461	80	74	630.1	15.2	1.2	0.0	0.0	0.0
	Wed	08/16/06	7:28 AM	642.6	630.8	11.0	6.0	26.5	NR	NA	31	18	14	0	13	17	31	385	21,499.2	213,900	459	89	74	663.8	33.7	0.0	0.0	0.0	0.0
	Thu	08/17/06	8:00 AM	653.2	641.0	10.6	10.2	31.5	NR	NA	30	17	16	0	13	14	30	411	21,780.9	281,700	452	92	75	678.2	14.4	2.7	3.3	6.5	6.6
	Fri	08/18/06	7:30 AM	662.8	650.5	9.6	9.5	29.3	NR	NA	25	18	18	0	7	7	25	440	22,029.4	248,500	434	94	77	692.1	13.9	1.5	0.9	0.6	0.6
	Sat	08/19/06	7:00 AM	671.5	659.2	8.7	8.7	23.5	NR	NA	30	17	17	0	13	13	30	424	22,254.9	225,500	432	95	78	699.6	7.5	2.9	3.5	7.0	7.0
	Sun	08/20/06	7:00 AM	682.6	670.3	11.1	11.1	25.0	NR	NA	28	18	17	0	10	11	28	440	22,535.3	280,400	421	97	80	714.4	14.8	2.0	2.6	7.4	7.4
3	Mon	08/21/06	7:03 AM	697.2	681.2	14.6	10.9	31.0	NR	NA	26	21	16	0	5	10	26	466	22,877.2	341,900	457	103	81	739.4	25.0	0.9	0.1	0.0	0.0
	Tue	08/22/06	7:11 AM	711.1	688.1	13.9	6.9	28.0	NR	NA	5	2	11	0	NA	NA	NA	NR	23,178.0	300,800	544	112	81	770.5	31.1	0.0	0.1	0.0	0.2
	Wed	08/23/06	7:09 AM	722.6	696.4	11.5	8.3	22.0	NR	NA	30	16	18	0	14	12	30	432	30,171.6	NA	#VALUE!	114	81	777.3	6.8	4.0	0.3	5.4	0.0
	Thu	08/24/06	7:14 AM	732.9	706.0	10.3	9.6	23.5	NR	NA	25	19	19	0	6	6	25	470	30,430.5	258,900	434	116	83	791.3	14.0	0.7	1.3	0.0	0.0
	Fri	08/25/06	6:55 AM	742.0	715.1	9.1	9.1	22.0	NR	NA	30	17	17	0	13	13	30	413	30,663.9	233,400	427	117	84	798.3	7.0	3.2	3.6	6.7	6.7
	Sat	08/26/06	7:20 AM	753.1	725.7	11.1	10.6	27.0	NR	NA	NR	NR	NR	0	NA	NA	NA	462	30,929.2	265,300	408	119	86	812.3	14.0	0.6	0.8	1.1	1.3
	Sun	08/27/06	9:00 AM	763.5	736.2	10.4	10.5	27.0	NR	NA	31	16	17	0	15	14	31	400	31,191.8	262,600	419	120	87	819.9	7.6	4.3	3.6	7.9	7.9
4	Mon	08/28/06	6:54 AM	774.1	768.1	10.6	31.9	24.3	NR	NA	32	19	18	5	13	14	27	399	31,433.8	242,000	253	122	88	831.7	11.8	2.8	3.4	6.2	6.2
	Tue	08/29/06	7:08 AM	786.9	759.6	12.8	NA	29.5	NR	NA	28	20	20	5	8	8	23	237	31,732.9	299,100	#VALUE!	124	90	846.6	14.9	1.1	0.5	0.0	0.0
	Wed	08/30/06	6:53 AM	799.0	772.3	12.1	12.7	27.5	NR	NA	28	20	19	5	8	9	23	434	32,029.1	296,200	398	126	92	863.8	17.2	1.3	1.3	1.3	0.7
	Thu	08/31/06	6:56 AM	811.7	784.5	12.7	12.2	24.5	NR	NA	34	18	17	5	16	17	29	361	32,319.1	290,000	388	127	93	874.1	10.3	5.1	5.7	5.6	5.6
	Fri	09/01/06	7:03 AM	822.5	795.0	10.8	10.5	25.0	NR	NA	29	20	19	5	9	10	24	425	32,575.2	256,100	401	129	95	891.5	17.4	1.5	1.5	3.3	3.9
	Sat	09/02/06	8:58 AM	833.0	805.4	10.5	10.4	24.5	NR	NA	33	18	17	5	15	16	28	377	32,823.7	248,500	396	130	96	900.0	8.5	3.9	4.5	8.2	8.2
	Sun	09/03/06	9:21 AM	843.7	816.1	10.7	10.7	24.5	NR	NA	29	20	20	5	9	9	24	417	33,082.4	258,700	403	132	98	914.4	14.4	1.2	0.1	1.6	1.4
5	Mon	09/04/06	8:35 AM	853.9	826.6	10.2	10.5	22.0	NR	NA	4	13	11	0	NA	NA	NA	0	40,047.1	NA	#VALUE!	133	99	921.9	7.5	5.2	4.6	8.3	8.3
	Tue	09/05/06	6:54 AM	865.4	838.2	11.5	11.6	24.0	NR	NA	34	18	18	5	16	16	29	381	40,329.1	282,000	407	135	101	940.6	18.7	4.5	3.9	6.9	6.8
	Wed	09/06/06	7:05 AM	876.2	844.3	10.8	6.1	27.0	NR	NA	31	20	19	5	11	12	26	470	40,600.3	271,200	580	137	103	958.0	17.4	2.3	2.9	5.8	5.8
	Thu	09/07/06	6:58 AM	886.8	860.0	10.6	15.7	27.0	NR	NA	29	21	19	5	8	10	24	425	40,864.2	263,900	348	139	105	975.0	17.0	0.7	1.4	0.8	0.7
	Fri	09/08/06	7:00 AM	899.0	872.4	12.2	12.4	27.0	NR	NA	28	22	19	5	6	9	23	426	41,159.2	295,000	400	141	107	993.0	18.0	0.5	1.1	0.0	0.0
	Sat	09/09/06	7:10 AM	908.6	882.0	9.6	9.6	25.0	NR	NA	32	19	18	5	13	14	27	401	41,397.0	237,800	413	142	108	1002.3	9.3	4.2	4.8	7.3	7.4
	Sun	09/10/06	7:05 AM	919.5	892.9	10.9	10.9	25.0	NR	NA	30	20	18	5	10	12	25	416	41,663.7	266,700	408	144	110	1020.0	17.7	2.1	2.7	7.7	7.6
6	Mon	09/11/06	6:59 AM	931.6	904.9	12.1	12.0	34.0	NR	NA	29	19	19	5	10	10	24	425	41,953.6	289,900	401	148	112	1043.2	23.2	1.8	1.8	1.1	1.8
	Tue	09/12/06	7:03 AM	942.8	916.2	11.2	11.3	27.0	NR	NA	5	12	11	5	NA	NA	NA	0	42,212.2	258,600	383	149	113	1058.5	15.3	5.8	5.0	7.2	7.2
	Wed	09/13/06	7:20 AM	953.6	927.0	10.8	10.8	26.0	NR	NA	33	19	19	5	14	14	28	382	42,472.4	260,200	402	149	115	1079.0	20.5	3.2	2.5	5.3	5.4
	Thu	09/14/06	6:59 AM	963.0	936.4	9.4	9.4	25.0	NR	NA	36	17	18	5	19	18	31	340	42,690.6	218,200	387	150	116	1090.2	11.2	5.5	4.9	6.7	6.7
	Fri	09/15/06	6:57 AM	973.6	947.4	10.6	11.0	20.0	NR	NA	33	18	19	5	15	14	28	393	42,954.5	263,900	407	152	118	1116.2	26.0	4.1	3.5	6.0	6.0
	Sat	09/16/06	10:00 AM	988.3	962.1	14.7	14.7	22.0	NR	NA	37	17	18	5	20	19	32	343	50,018.3	NA	#VALUE!	154	120	1138.7	22.5	5.1	4.4	1.9	1.9
	Sun	09/17/06	9:30 AM	998.6	969.5	10.3	7.4	24.0	NR	NA	27	20	21	5	7	6	22	431	50,191.6	173,300	335	156	122	1161.5	22.8	0.9	0.4	0.0	0.0
7	Mon	09/18/06	7:42 AM	1,006.5	981.1	7.9	11.6	23.0	NR	NA	37	27	1	5	10	NA	32	315	50,455.5	263,900	468	158	123	1179.5	18.0	0.1	0.0	0.0	0.0
	Tue	09/19/06	7:08 AM	1,016.6	990.9	10.1	9.8	19.8	NR	NA	30	20	19	5	10	11	25	417	50,698.6	243,100	407	159	124	1201.9	22.4	2.2	2.2	5.4	4.9
	Wed	09/20/06	4:25 AM	1,030.2	1,004.4	13.6	13.5	14.0	NR	NA	33	12	11	5	21	22	28	391	51,015.0	316,400	389	160	126	1228.9	27.0	5.7	5.1	4.3	4.2
	Thu	09/21/06	7:03 AM	1,041.0	1,015.2	10.8	10.8	18.0	NR	NA	32	20	17	5	12	15	27	378	51,279.2	264,200	408	164	130	1253.4	24.5	3.2	3.9	5.6	5.6
	Fri	09/22/06	7:00 AM	1,051.4	1,025.7	10.4	10.5	16.5	NR	NA	29	21	19	5	8	10	24	422	51,525.3	246,100	393	166	132	1274.8	21.4	1.5	2.2	5.4	5.5
	Sat	09/23/06	9:00 AM	1,061.7	1,035.9	10.3	10.2	15.0	NR	NA	37	36	26	5	NA	11	32	400	51,774.3	249,000	405	167	134	1295.1	20.3	0.0	0.4	0.0	0.0
	Sun	09/24/06	9:45 AM	1,072.6	1,047.1	10.9	11.2	18.5	NR	NA	35	17	17	5	18	18	30	327	52,038.5	264,200	399	169	135	1310.2	15.1	4.8	5.4	8.1	8.1
8	Mon	09/25/06	7:00 AM	1,083.4	1,057.7	10.8	10.6	9.5	7.0	522	31	19	20	5	12	11	26	420	52,296.8	258,300	402	171	137	1333.1	22.9	3.5	2.8	6.2	6.2
	Tue	09/26/06	7:01 AM	1,094.6	1,068.7	11.2	11.0	9.5	7.0	542	37	2	27	5	NA	10	32	308	52,546.0	249,200	374	172	139	1350.7	17.6	0.0	0.1	0.0	0.0
	Wed	09/27/06	7:04 AM	1,107.0	1,080.8	12.4	12.1	8.0	10.0	509	37	2	27	5	NA	10	32	306	52,835.5	289,500	394	174	141	1376.2	25.5	0.0	0.0	0.0	0.1
	Thu	09/28/06	6:59 AM	1,119.6	1,093.9	12.6	13.1	9.5	7.0	1078	40	31	30	5	9	10	35	268	53,148.4	312,900	406	177	143	1400.4	24.2	2.8	3.3	5.5	5.5
	Fri	09/29/06	6:53 AM	1,130.0	1,104.3	10.4	10.4	9.5	6.5	NA	32	20	19	5	12	13	27	406	60,128.9	NA	#VALUE!	179	145	1418.2	17.8	2.8	3.4	6.3	6.1
	Sat	09/30/06	7:10 AM	1,139.7	1,114.2	9.7	9.9	7.0	8.5	523	31	21	19	5	10	12	26	411	60,371.5	242,600	413	181	147	1438.7	20.5	2.0	2.6	6.4	6.5
	Sun	10/01/06	7:25 AM	1,151.8	1,125.5	12.1	11.3	7.0	9.0	497	32	20	18	5	12	14	27	382	60,635.0	263,500	376	183	149	1456.4	17.7	2.8	3.4	7.4	7.4

Table A-1. US EPA Arsenic Demonstration Project at Arnaudville, LA - Daily System Operation Log Sheet (Continued)

											Pressure Filtration											Backwash				Since Last BW			
Week No.	Day of Week	Date	Time	Tank A Hour Meter hrs	Tank B Hour Meter hrs	TA Run Time hrs	TB Run Time hrs	$KMnO_4$ Tank 1 Level[(a)] inches	$KMnO_4$ Tank 2 Level (Iron) inches	Estimated $KMnO_4$ Dosage µg/L as Mn	Influent psig	Outlet Tank A psig	Outlet Tank B psig	Effluent psig	Inlet-TA psig	Inlet-TB psig	Inlet-Effluent psig	Flow rate gpm	Totalizer to Distribution kgal	Gallon Usage gal	Daily Average Flowrate gpm	Tank A No.	Tank B No.	Total Volume kgal	Daily Volume kgal	Run Time Tank A hrs	Run Time Tank B hrs	Standby Time Tank A hrs	Standby Time Tank B hrs
	Mon	10/02/06	6:54 AM	1,163.0	1,137.5	11.2	12.0	8.0	7.5	448	35	18	17	5	17	18	30	353	60,917.9	282,900	407	185	151	1477.4	21.0	4.6	5.3	6.3	6.3
	Tue	10/03/06	7:03 AM	1,174.0	1,148.5	11.0	11.0	8.0	6.0	437	34	18	18	5	16	16	29	363	61,180.1	262,200	397	187	153	1496.6	19.2	4.8	5.3	6.6	6.6
	Wed	10/04/06	7:01 AM	1,186.0	1,160.3	12.0	11.8	8.0	6.8	429	27	20	20	5	7	7	22	433	61,461.5	281,400	394	190	156	1526.8	30.2	0.9	0.0	0.9	0.6
9	Thu	10/05/06	6:50 AM	1,198.5	1,172.4	12.5	12.1	9.0	7.0	470	30	19	20	5	11	10	25	409	61,740.1	278,600	378	192	158	1545.8	19.0	2.5	2.5	5.1	5.6
	Fri	10/06/06	7:04 AM	1,209.5	1,183.4	11.0	11.0	7.5	5.8	410	39	32	31	5	7	8	34	279	62,004.2	264,100	400	194	160	1564.8	19.0	2.7	3.4	5.5	5.5
	Sat	10/07/06	9:50 AM	1,221.5	1,194.2	12.0	10.8	7.0	7.5	399	35	25	27	5	10	8	30	300	62,301.4	297,200	436	197	163	1586.3	21.5	4.6	5.3	6.3	6.3
	Sun	10/08/06	9:04 AM	1,232.6	1,206.6	11.1	12.4	7.0	7.5	417	38	19	19	5	19	19	33	320	62,585.5	284,100	404	200	166	1608.1	21.8	1.9	1.9	3.8	4.3
	Mon	10/09/06	7:00 AM	1,244.8	1,219.1	12.2	12.5	7.5	6.5	387	30	21	21	5	9	9	25	429	62,881.0	295,500	399	203	169	1629.1	21.0	2.0	2.0	4.2	4.8
	Tue	10/10/06	6:42 AM	1,256.1	1,230.2	11.3	11.1	6.5	5.5	369	43	20	0	5	NA	NA	38	226	63,147.1	266,100	396	205	171	1644.9	15.8	4.7	0.0	6.0	0.0
	Wed	10/11/06	7:00 AM	1,267.2	1,241.5	11.1	11.3	7.0	5.5	15	30	20	19	5	10	11	25	318	70,148.8	7,001,700	10,420	208	174	1667.3	22.4	2.8	3.4	6.2	6.2
10	Thu	10/12/06	6:48 AM	1,278.2	1,252.1	11.0	10.6	8.5	8.5	515	30	20	20	5	10	10	25	418	70,418.7	269,900	417	211	177	1689.5	22.2	1.7	1.7	3.3	3.8
	Fri	10/13/06	7:05 AM	1,289.9	1,263.7	11.7	11.6	10.0	14.0	716	34	19	17	5	15	17	29	365	70,692.9	274,200	392	213	179	1704.1	14.6	2.9	3.4	5.0	5.0
	Sat	10/14/06	8:30 AM	1,301.1	1,274.6	11.2	10.9	14.0	10.0	705	35	19	20	5	16	15	30	412	70,971.2	278,300	420	216	182	1725.0	20.9	1.7	1.6	0.9	1.4
	Sun	10/15/06	9:33 AM	1,313.0	1,286.9	11.9	12.3	15.0	11.5	766	43	1	19	5	NA	NA	38	244	71,254.2	283,000	390	218	184	1739.3	14.3	0.0	3.9	0.0	7.9
	Mon	10/16/06	7:10 AM	1,324.6	1,298.0	11.6	NA	11.0	13.5	735	29	22	19	5	7	10	24	418	71,526.9	272,700	#VALUE!	221	187	1761.4	22.1	1.4	1.7	1.7	1.9
	Tue	10/17/06	7:28 AM	1,334.8	1,307.9	10.2	9.9	11.0	18.0	970	32	20	18	5	12	14	27	381	71,771.3	244,400	405	223	189	1776.7	15.3	1.8	2.1	3.4	3.6
	Wed	10/18/06	7:30 AM	1,345.7	1,318.7	10.9	10.8	13.0	24.5	1145	27	23	20	5	4	7	22	440	72,039.1	267,800	411	226	192	1807.3	30.6	0.6	1.2	0.0	0.0
11	Thu	10/19/06	7:30 AM	1,356.9	1,330.0	11.2	11.3	12.0	20.0	NA	31	19	20	5	12	11	26	407	2,294.9	NA	#VALUE!	228	194	1825.9	18.6	2.4	3.0	5.3	5.1
	Fri	10/20/06	7:00 AM	1,368.0	1,341.2	11.1	11.2	12.0	17.0	880	31	18	18	5	13	13	26	345	2,564.3	269,400	403	230	196	1844.8	18.9	5.3	4.7	5.1	5.1
	Sat	10/21/06	7:05 AM	1,376.6	1,340.4	8.6	NA	10.0	14.5	912	30	20	22	5	10	8	25	402	2,783.9	219,600	#VALUE!	232	199	1865.7	20.9	2.6	1.1	6.0	4.4
	Sun	10/22/06	7:15 AM	1,387.5	1,360.3	10.9	NA	11.5	14.5	817	33	19	19	5	14	14	28	388	3,044.3	260,400	#VALUE!	234	201	1882.6	16.9	3.3	2.8	7.7	7.8
	Mon	10/23/06	7:10 AM	1,399.8	1,372.8	12.3	12.5	14.0	13.5	NA	29	22	19	5	7	10	24	417	69.5	NA	#VALUE!	237	204	1908.4	25.8	1.2	1.8	2.3	2.3
	Tue	10/24/06	7:30 AM	1,410.2	1,383.1	10.4	10.3	12.5	10.0		34	20	17	5	14	17	29	386	324.2	254,700	410	234	206	1923.5	15.1	2.8	3.4	6.2	6.2
	Wed	10/25/06	7:00 AM	1,421.3	1,393.6	11.1	10.5	10.0	8.0	567	33	19	19	5	14	14	28	381	583.9	259,700	401	241	209	1944.5	21.0	2.7	2.3	5.0	5.0
12	Thu	10/26/06	6:43 AM	1,432.3	1,404.7	11.0	11.1	13.5	12.0	781	27	23	21	5	4	6	22	420	850.8	266,900	403	244	212	1966.4	21.9	0.0	0.6	0.0	0.0
	Fri	10/27/06	6:50 AM	1,440.7	1,413.5	8.4	8.8	11.5	12.0	849	30	24	18	5	6	12	25	409	1,077.2	226,400	439	246	214	1981.0	14.6	0.7	2.4	0.7	5.2
	Sat	10/28/06	7:00 AM	1,453.8	1,426.6	13.1	13.1	18.0	17.0	878	30	22	18	5	8	12	25	418	1,403.1	325,900	415	249	217	2006.8	25.8	1.5	2.0	0.9	0.9
	Sun	10/29/06	9:20 AM	1,468.7	1,441.2	14.9	14.6	19.0	11.5	1647	37	1	28	5	NA	9	32	335	1,554.6	151,500	171	252	221	2032.3	25.5	0.0	0.0	0.0	0.0
	Mon	10/30/06	6:48 AM	1,472.5	1,445.6	3.8	4.4	5.6	6.0	308	27	23	20	5	4	7	22	427	1,862.3	307,700	1,258	254	222	2043.2	10.9	0.5	1.1	0.0	0.0
	Tue	10/31/06	6:50 AM	1,483.8	1,456.9	11.3	11.3	15.0	14.0	918	34	20	17	5	14	17	29	352	2,120.7	258,400	381	256	224	2064.5	21.3	2.6	3.3	6.2	6.2
	Wed	11/01/06	7:02 AM	1,494.5	1,468.0	10.7	11.1	15.0	14.0	907	30	23	18	5	7	12	25	396	2,382.1	261,400	400	259	227	2092.6	28.1	1.6	2.2	1.8	1.1
13	Thu	11/02/06	6:50 AM	1,503.2	1,478.8	8.7	10.8	16.0	14.5	948	32	20	18	5	12	14	27	379	2,645.3	263,200	455	261	230	2116.9	24.3	2.4	2.3	4.2	3.7
	Fri	11/03/06	6:47 AM	1,517.5	1,489.9	14.3	11.1	10.0	11.0	654	33	19	19	5	14	14	28	389	2,907.9	262,600	350	263	233	2140.5	23.6	2.6	2.0	5.1	5.0
	Sat	11/04/06	7:00 AM	1,527.1	1,499.4	9.6	9.5	14.0	13.5	967	39	4	23	5	NA	16	34	286	3,140.6	232,700	406	265	236	2159.5	19.0	0.0	1.3	0.0	3.9
	Sun	11/05/06	8:45 AM	1,539.1	1,511.7	12.0	12.3	16.0	16.5	NA	33	20	17	5	13	16	28	369	158.9	NA	#VALUE!	269	239	2186.7	27.2	2.5	3.1	3.7	3.7
	Mon	11/06/06	6:54 AM	1,550.3	1,523.1	11.2	11.4	15.5	14.5	898	33	20	17	5	13	16	28	375	432.1	273,200	403	272	242	2211.0	24.3	1.8	2.4	4.8	4.8
	Tue	11/07/06	6:56 AM	1,562.0	1,534.6	11.7	11.5	16.5	15.0	951	36	19	16	5	17	20	31	342	703.0	270,900	389	275	245	2242.5	31.5	2.3	2.9	6.0	6.0
	Wed	11/08/06	6:56 AM	1,572.6	1,545.5	10.6	10.9	17.0	16.0	1009	29	22	18	5	7	11	24	402	970.5	267,500	415	279	249	2277.8	35.3	0.8	0.0	0.0	0.0
14	Thu	11/09/06	7:47 AM	1,584.4	1,557.1	11.8	11.6	16.0	17.0	1014	33	19	19	5	14	14	28	381	1,236.8	266,300	379	282	252	2304.0	26.2	2.4	2.4	4.4	5.3
	Fri	11/10/06	7:05 AM	1,595.5	1,568.6	11.1	11.5	15.0	16.0	963	27	24	20	5	3	7	22	437	1,500.0	263,200	388	286	256	2339.8	35.8	0.0	0.6	0.0	0.0
	Sat	11/11/06	7:15 AM	1,606.1	1,578.5	10.6	9.9	15.0	15.5	993	30	21	20	5	9	10	25	415	1,751.1	251,100	409	289	259	2362.9	23.1	1.3	1.2	1.9	2.4
	Sun	11/12/06	7:10 AM	1,617.5	1,590.3	11.4	11.8	15.0	17.0	956	28	23	19	5	5	9	23	420	2,024.9	273,800	394	293	263	2397.3	34.4	0.2	0.8	0.0	0.0
	Mon	11/13/06	7:10 AM	1,630.9	1,603.4	13.4	13.1	18.5	17.0	950	33	19	19	5	14	14	28	382	2,330.6	305,700	385	297	267	2428.5	31.2	2.3	2.3	4.6	5.2
	Tue	11/14/06	7:00 AM	1,642.7	1,615.0	11.8	11.6	18.0	15.0	986	32	19	18	5	13	14	27	379	2,604.2	273,600	390	301	271	2461.7	33.2	2.8	2.8	3.2	3.7
	Wed	11/15/06	7:12 AM	1,655.6	1,628.2	12.9	13.2	18.0	17.0	910	34	20	17	5	14	17	29	350	2,918.8	314,600	402	306	276	2575.7	114.0	1.3	2.1	0.7	0.7
15	Thu	11/16/06	6:47 AM	1,668.5	1,641.3	12.9	13.1	18.0	17.5	937	36	20	16	5	16	20	31	346	3,228.7	309,900	397	311	281	2571.7	NA	1.5	2.3	2.5	2.5
	Fri	11/17/06	6:54 AM	1,681.6	1,654.2	13.1	12.9	18.0	17.0	NA	43	18	12	5	25	31	38	210	259.8	NA	#VALUE!	316	286	2623.7	52.0	2.0	3.2	0.0	0.0
	Sat	11/18/06	9:30 AM	1,696.8	1,670.3	15.2	16.1	20.0	19.0	845	35	18	16	5	17	19	30	343	637.3	377,500	402	323	293	2693.1	69.4	1.8	2.2	0.0	0.0
	Sun	11/19/06	10:00 AM	1,716.8	1,690.4	20.0	20.1	19.0	18.0	1197	30	18	21	5	12	9	25	398	890.1	252,800	210	329	300	2700.4	7.3	1.4	0.8	0.0	0.0
	Mon	11/20/06	7:33 AM	1,723.5	1,697.4	6.7	7.0	16.5	14.5	668	39	48	24	5	NA	15	34	400	1,269.5	379,400	924	333	305	2817.4	117.0	0.0	0.0	0.3	0.0
	Tue	11/21/06	6:53 AM	1,739.0	1,712.7	15.5	15.3	17.0	19.5	815	7	12	11	5	NA	NA	NA	0	1,636.0	366,500	397	340	312	2900.6	83.2	1.4	0.7	0.2	0.2
	Wed	11/22/06	7:16 AM	1,755.7	1,729.7	16.7	17.0	16.0	17.0	667	41	1	19	5	NA	22	36	240	2,040.9	404,900	401	346	318	3020.2	119.6	0.0	0.0	1.5	0.0
16	Thu	11/23/06	9:00 AM	1,771.0	1,745.6	15.3	15.9	18.0	17.5	748	37	23	17	5	14	20	32	413	2,429.0	388,100	415	354	326	3084.7	64.5	0.2	0.9	0.0	0.0
	Fri	11/24/06	8:45 AM	1,784.9	1,758.6	13.9	13.0	16.0	19.0	923	36	1	28	5	NA	8	31	337	2,739.3	310,300	385	359	332	3123.0	38.3	0.0	0.0	0.0	0.0
	Sat	11/25/06	8:30 AM	1,797.3	1,771.4	12.4	12.8	17.0	14.5	826	35	16	19	5	19	16	30	361	3,051.2	311,900	413	365	338	3166.1	43.1	1.7	0.8	0.8	0.8
	Sun	11/26/06	9:54 AM	1,809.7	1,783.5	12.4	12.1	17.0	14.0	NA	28	19	23	5	9	5	23	429	77.5	NA	#VALUE!	371	345	3211.9	45.8	0.9	0.1	0.0	0.0
	Mon	11/27/06	7:01 AM	1,822.2	1,795.5	12.5	12.0	14.5	13.0	760	38	26	50	5	12	NA	33	400	373.4	295,900	403	376	350	3249.3	37.4	0.5	0.0	0.0	0.0
	Tue	11/28/06	6:51 AM	1,835.7	1,809.2	13.5	13.7	14.0	14.0	714	43	1	17	5	NA	26	38	215	694.0	320,600	393	381	356	8.2	NA	0.0	1.2	0.0	0.9
	Wed	11/29/06	8:30 AM	1,850.2	1,823.6	14.5	14.4	17.8	14.0	736	39	19	21	5	20	18	34	416	1,047.0	353,000	407	388	362	55.8	47.6	1.9	1.2	0.0	0.0
17	Thu	11/30/06	7:03 AM	1,861.0	1,834.5	10.8	10.9	14.0	10.5	838	36	30	0	5	6	NA	31	348	1,286.2	239,200	367	390	364	88.0	32.2	0.0	0.0	0.0	0.0
	Fri	12/01/06	7:00 AM	1,876.0	1,848.5	15.0	14.0	15.0	16.0	733	45	13	54	5	32	NA	40	341	1,632.3	346,100	398	396	370	171.5	83.5	2.1	0.0	1.8	0.0
	Sat	12/02/06	7:15 AM	1,888.5	1,861.0	12.5	12.5	14.0	15.0	NA	46	12	63	5	34	NA	41	345	NA	NA	#VALUE!	401	376	227.5	56.0	3.2	0.0	1.6	0.0
	Sun	12/03/06	7:00 AM	1,900.5	1,874.5	12.0	13.5	15.0	17.0	NA	46	12	11	5	34	35	41	322	2,244.6	NA	#VALUE!	408	383	294.0	66.5	0.0	0.0	0.0	0.0
	Mon	12/04/06	8:10 AM	1,918.5	1,891.7	18.0	17.2	17.0	17.0	774	15	15	14	5	0	1	10	276	2,603.9	359,300	340	414	390	352.6	58.6	0.0	0.1	0.0	0.0
	Tue	12/05/06	6:59 AM	1,933.5	1,906.3	15.0	14.6	17.0	15.0	925	43	56	16	5	-13	27	38	400	2,886.7	282,800	319	418	395	388.3	35.7	0.0	0.8	0.0	0.0
	Wed	12/06/06	11:30 AM	NR	NR	NA	NA	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	NR	NA	#VALUE!	NR	NR	NR	NA	NR	NR	NR	NR
18	Thu	12/07/06	7:00 AM	1,965.2	1,937.7	NA	NA	6.5	3.0	NA	27	22	0	5	5	27	22	272	146.6	NA	#VALUE!	431	407	463.1	NA	0.1	0.0	0.0	0.0
	Fri	12/08/06	6:54 AM	1,982.0	1,953.7	16.8	16.0	off	off	NA	29	23	19	5	6	10	24	335	483.3	336,700	342	436	413	492.7	29.6	0.6	1.3	0.0	0.0
	Sat	12/09/06	NR	NR	NR	NA	NA	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	NR	NA	#VALUE!	NR	NR	NR	NA	NR	NR	NR	NR
	Sun	12/10/06	NR	NR	NR	NA	NA	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	NR	NA	#VALUE!	NR	NR	NR	NA	NR	NR	NR	NR
	Mon	12/11/06	7:00 AM	NR	NR	NA	NA	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	NR	NA	#VALUE!	NR	NR	NR	NR	NR	NR	NR	NR
	Tue	12/12/06	6:48 AM	NR	NR	NA	NA	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	NR	NA	#VALUE!	NR	NR	NR	NR	NR	NR	NR	NR
	Wed	12/13/06	7:03 AM	1,991.6	1,963.1	NA	NA	NR	NR	NA	35	20	20	5	15	15	30	355	687.3	NA	#VALUE!	437	414	499.6	NA	4.6	5.2	5.3	5.3
19	Thu	12/14/06	9:10 AM	2,002.0	1,973.7	10.4	10.6	10.0	12.0	776	37	18	19	17/20	19	18	NA	326	919.2	231,900	368	437	414	499.6	0.0	15.0	15.8	17.0	17.0
	Fri	12/15/06	9:20 AM	2,012.4	1,984.4	10.4	10.7	17.0	11.0	947	36	20	21	20/22	16	15	NA	330	1,161.1	241,900	382	438	415	509.2	9.6	9.2	8.4	12.1	12.0
	Sat	12/16/06	NA	2,023.4	1,994.8	11.0	10.4	7.0	12.0	579	34	20	19	20/20	14	15	NA	358	1,429.5	268,400	418	439	416	517.4	8.2	8.1	8.5	12.6	12.6
	Sun	12/17/06	NA	2,034.4	2,006.6	11.0	11.8	6.0	10.0	553	31	26	19	26/20	5	12	NA	429	1,666.3	236,800	347	440	417	525.3	7.9	2.4	4.0	5.5	10.3

Table A-1. US EPA Arsenic Demonstration Project at Arnaudville, LA - Daily System Operation Log Sheet (Continued)

											Pressure Filtration											Backwash				Since Last BW			
Week No.	Day of Week	Date	Time	Tank A Hour Meter hrs	Tank B Hour Meter hrs	TA Run Time hrs	TB Run Time hrs	$KMnO_4$ Tank 1 Level[(a)] inches	$KMnO_4$ Tank 2 Level (Iron) inches	Estimated $KMnO_4$ Dosage µg/L as Mn	Influent psig	Outlet Tank A psig	Outlet Tank B psig	Effluent psig	Inlet-TA psig	Inlet-TB psig	Inlet-Effluent psig	Flow rate gpm	Totalizer to Distribution kgal	Gallon Usage gal	Daily Average Flowrate gpm	Tank A No.	Tank B No.	Total Volume kgal	Daily Volume kgal	Run Time Tank A hrs	Run Time Tank B hrs	Standby Time Tank A hrs	Standby Time Tank B hrs
20	Mon	12/18/06	6:58 AM	2,045.1	2,016.3	10.7	9.7	6.0	9.0	517	34	17	23	17/25	17	11	NA	362	1,903.4	237,100	388	440	418	528.9	3.6	13.1	5.8	15.2	8.1
	Tue	12/19/06	7:00 AM	2,055.8	2,027.3	10.7	11.0	6.0	9.0	505	40	20	0	20/0	20	40	NA	216	2,146.5	243,100	373	441	419	536.4	7.5	10.7	10.4	0.0	0.0
	Wed	12/20/06	7:00 AM	2,067.3	2,039.3	11.5	12.0	7.0	11.0	567	34	22	17	22/17	12	17	NA	363	2,406.1	259,600	368	442	420	546.5	10.1	5.8	12.0	5.4	10.7
	Thu	12/21/06	6:55 AM	2,077.9	2,049.8	10.6	10.5	6.0	11.0	563	9	12	10	11/11	NA	NA	NA	0	2,653.2	247,100	390	443	421	557.5	11.0	3.1	10.0	5.6	11.3
	Fri	12/22/06	1:00 AM	2,092.4	2,064.1	14.5	14.3	7.0	13.0	529	34	24	17	28/17	10	17	NA	364	2,962.4	309,200	358	444	421	569.5	12.0	4.1	12.3	3.7	12.9
	Sat	12/23/06	7:05 AM	2,099.0	2,070.3	6.6	6.2	7.0	8.0	853	35	19	21	17/16	16	14	NA	336	3,106.2	143,800	375	444	423	574.5	5.0	10.6	5.6	14.0	4.9
	Sun	12/24/06	8:43 AM	2,112.6	2,084.3	13.6	14.0	7.0	10.0	NA	34	24	17	25/18	10	17	NA	360	129.2	NA	#VALUE!	446	424	595.3	20.8	2.1	8.2	4.8	9.9
21	Mon	12/25/06	10:00 AM	2,127.7	2,098.6	15.1	14.3	8.0	12.0	514	10	11	10	11/12	NA	NA	NA	0	447.2	318,000	361	447	426	611.3	16.0	7.9	3.1	8.4	0.8
	Tue	12/26/06	8:30 AM	2,137.4	2,108.3	9.7	9.7	4.5	8.0	489	34	16	12	17/22	18	22	NA	335	656.1	208,900	359	448	427	622.9	11.6	8.0	3.4	8.2	4.3
	Wed	12/27/06	6:52 AM	2,148.2	2,119.2	10.8	10.9	7.0	9.0	546	34	23	17	25/19	11	17	NA	355	895.7	239,600	368	450	428	640.5	17.6	2.4	7.2	5.4	8.2
	Thu	12/28/06	6:45 AM	2,159.9	2,130.8	11.7	11.6	6.0	10.0	514	33	18	21	19/23	15	12	NA	371	1,150.2	254,500	364	451	430	656.8	16.3	5.6	2.5	7.7	5.7
	Fri	12/29/06	7:15 AM	2,171.3	2,143.1	11.4	12.3	6.0	10.0	499	34	16	16	23/19	18	18	NA	378	1,412.6	262,400	370	453	431	676.5	19.7	2.1	6.8	5.0	6.8
	Sat	12/30/06	10:50 AM	2,184.6	2,156.6	13.3	13.5	6.5	11.0	476	40	36	31	30/30	4	9	NA	230	1,713.1	300,500	374	455	433	699.8	23.3	1.0	5.4	0.0	7.8
	Sun	12/31/06	2:10 AM	2,198.5	2,170.7	13.9	14.1	10.0	11.0	551	33	24	17	24/17	9	16	NA	365	2,024.9	311,800	371	457	435	719.9	20.1	2.1	5.9	0.7	5.2
22	Mon	01/01/07	1:00 AM	2,210.1	2,181.1	11.6	10.4	6.0	8.0	480	12	11	10	11/11	NA	NA	NA	0	2,263.5	238,600	363	458	437	732.6	12.7	4.9	1.2	5.3	0.5
	Tue	01/02/07	7:40 AM	2,217.8	2,188.8	7.7	7.7	5.0	6.5	527	32	20	24	21/27	12	8	NA	401	2,442.1	178,600	387	459	438	742.5	9.9	4.7	1.0	7.3	2.7
	Wed	01/03/07	6:56 AM	2,228.9	2,201.1	11.1	12.3	6.5	9.0	491	33	25	17	21/19	8	16	NA	378	2,700.4	258,300	369	461	439	756.8	14.3	1.5	5.9	5.3	7.8
	Thu	01/04/07	6:55 AM	2,241.2	2,212.6	12.3	11.5	6.0	9.0	472	9	11	12	10/11	NA	NA	NA	0	2,960.5	260,100	365	462	441	771.2	14.4	5.0	1.1	5.7	1.9
	Fri	01/05/07	7:05 AM	2,251.9	2,222.7	10.7	10.1	6.0	9.0	519	36	18	20	16/21	18	16	NA	340	3,197.1	236,600	379	463	442	781.5	10.3	7.9	4.0	9.0	6.5
	Sat	01/06/07	10:00 AM	2,264.6	2,235.1	12.7	12.4	6.0	9.0	NA	31	19	24	18/25	12	7	NA	380	206.8	NA	#VALUE!	465	444	802.5	21.0	4.1	1.1	6.1	0.0
	Sun	01/07/07	8:10 AM	2,275.0	2,245.4	10.4	10.3	5.0	8.0	457	34	18	20	17/21	16	14	NA	366	439.4	232,600	375	466	445	811.6	9.1	6.7	4.1	7.7	6.7
23	Mon	01/08/07	6:51 AM	2,286.5	NR	11.5	NA	9.0	10.0	587	9	11	10	11/11	NA	NA	NA	0	704.3	264,900	#VALUE!	468	447	830.2	18.6	2.4	0.9	5.3	0.3
	Tue	01/09/07	8:00 AM	2,298.7	2,270.9	12.2	NA	9.0	10.0	539	33	25	15	10/13.5	8	18	NA	352.7	992.8	288,500	#VALUE!	470	448	845.0	14.8	1.2	5.3	0.0	5.7
	Wed	01/10/07	7:03 AM	2,309.5	2,281.6	10.8	10.7	9.0	9.0	591	32	17	23	17/25	15	9	NA	394.8	1,242.1	249,300	387	471	450	859.3	14.3	5.3	1.6	4.6	1.0
	Thu	01/11/07	6:50 AM	2,319.0	2,291.8	9.5	10.2	8.0	9.0	591	32	26	17	27/22	6	15	NA	401.5	1,477.3	235,200	398	473	451	874.6	15.3	0.0	4.7	0.0	6.6
	Fri	01/12/07	7:05 AM	2,331.0	2,303.2	12.0	11.4	9.0	9.0	549	33	17	22	23/18	16	11	NA	389.8	1,745.5	268,200	382	474	453	889.3	14.7	5.0	1.8	6.3	5.3
	Sat	01/13/07	7:20 AM	2,341.3	2,314.0	10.3	10.8	9.0	10.0	645	32	26	17	12/21	6	15	NA	415.6	1,986.3	240,800	381	476	454	903.3	14.0	0.1	5.8	0.0	7.2
	Sun	01/14/07	7:25 AM	2,352.6	2,324.5	11.3	10.5	9.0	9.0	547	33	19	22	23/19	14	11	NA	414.9	2,255.5	269,200	412	477	456	917.8	14.5	4.7	1.9	8.8	7.1
24	Mon	01/15/07	6:59 AM	2,364.9	2,336.8	12.3	12.3	9.0	9.0	528	34	23	16	23/16	11	18	NA	380	2,534.3	278,800	378	479	457	930.5	12.7	2.1	6.8	6.1	9.1
	Tue	01/16/07	7:00 AM	2,376.6	2,348.4	11.7	11.6	7.0	9.0	488	34	18	19	19/21	16	15	NA	385	2,802.6	268,300	384	480	459	943.9	13.4	6.2	3.9	6.0	5.6
	Wed	01/17/07	7:00 AM	2,387.1	2,359.4	10.5	11.0	6.0	8.0	445	39	24	0	25/2	15	39	NA	303	3,060.1	257,500	399	482	460	958.4	14.5	2.9	0.0	5.2	0.0
	Thu	01/18/07	7:02 AM	2,398.6	2,370.9	11.5	11.5	6.0	8.0	NA	9	11	10	11/12	NA	NA	NA	0	57.8	NA	#VALUE!	484	462	978.3	19.9	1.6	5.4	1.3	5.7
	Fri	01/19/07	7:07 AM	2,410.4	2,382.4	11.8	11.5	7.0	9.0	474	41	58	19	0/21	NA	NA	NA	218	334.0	276,200	395	485	464	995.3	17.0	0.0	4.1	0.0	5.3
	Sat	01/20/07	8:00 AM	2,430.5	2,402.1	20.1	19.7	12.0	13.0	442	35	16	18	20	19	17	NA	392	796.6	462,600	387	488	467	1020.4	25.1	5.0	2.2	1.7	0.4
	Sun	01/21/07	7:00 AM	2,438.6	2,409.8	8.1	7.7	6.0	7.0	575	35	17	20	22	18	15	NA	307	981.5	184,900	390	489	468	1029.1	8.7	6.2	3.3	6.0	0.6
25	Mon	01/22/07	7:07 AM	2,447.9	2,419.7	9.3	9.9	5.0	7.0	448	34	22	15	23/17	12	19	NA	365	1,200.7	219,200	381	491	469	1041.3	12.2	1.8	6.5	3.1	6.5
	Tue	01/23/07	7:25 AM	2,460.6	2,431.5	12.7	11.8	8.0	7.0	436	35	16	19	23	19	16	NA	353	1,482.3	281,600	384	492	471	1055.0	13.7	7.6	4.0	5.7	5.1
	Wed	01/24/07	7:01 AM	2,471.0	2,442.3	10.4	10.8	16.0	17.0	1072	34	21	16	22	13	18	NA	360	1,734.1	251,800	396	494	472	1069.0	14.0	2.6	6.4	4.9	6.6
	Thu	01/25/07	7:15 AM	2,484.1	2,455.2	13.1	12.9	9.0	9.0	495	32	25	16	18/25	7	16	NA	410	2,031.7	297,600	382	496	474	1091.3	22.3	0.5	4.7	0.0	5.2
	Fri	01/26/07	7:02 AM	2,497.2	2,468.4	13.1	13.2	9.0	9.0	499	33	17	21	18/23	16	12	NA	384	2,326.9	295,200	374	497	476	1106.4	15.1	5.5	2.1	5.2	3.4
	Sat	01/27/07	7:50 AM	2,509.4	2,481.0	12.2	12.6	9.0	9.0	515	40	23	NR	24/3	17	NA	NA	280	2,612.8	285,900	384	499	477	1121.8	15.4	3.1	0.0	4.7	0.0
	Sun	01/28/07	8:30 AM	2,522.9	2,494.1	13.5	13.1	9.0	9.0	482	29	18	11	19/12	11	18	NA	450	2,918.1	305,300	383	501	479	1144.0	22.2	1.7	5.5	1.6	7.2
26	Mon	01/29/07	7:00 AM	2,537.0	2,508.3	14.1	14.2	9.0	9.0	450	33	24	16	18/25	9	17	NA	375	3,244.9	326,800	385	503	481	1164.2	20.2	0.8	5.9	0.0	5.6
	Tue	01/30/07	6:57 AM	2,550.9	2,521.7	13.9	13.4	9.0	9.0	NA	35	17	19	1720	18	16	NA	375	273.1	NA	#VALUE!	504	483	1181.9	17.7	6.5	3.8	4.8	4.8
	Wed	01/21/07	7:18 AM	2,565.6	2,536.3	14.7	14.6	9.0	9.0	467	33	16	20	19/23	17	13	NA	400	588.3	315,200	359	506	485	1202.4	20.5	5.9	2.3	5.3	4.0
	Thu	02/01/07	7:00 AM	2,579.3	2,550.0	13.7	13.7	9.0	9.0	471	33	17	22	17/24	16	11	NA	370	901.0	312,700	380	508	487	1221.3	18.9	5.6	1.7	4.0	0.9
	Fri	02/02/07	7:02 AM	2,595.6	2,566.4	16.3	16.4	13.0	11.0	537	36	17	20	10	19	16	NA	375	1,266.4	365,400	372	510	489	1241.0	19.7	7.2	3.3	3.7	3.7
	Sat	02/03/07	7:15 AM	2,615.2	2,585.9	19.6	19.5	12.0	17.0	541	33	19	22	24/19	14	11	NA	420	1,705.1	438,700	374	513	492	1282.1	41.1	5.0	1.7	2.1	2.1
	Sun	02/04/07	7:00 AM	2,631.9	2,602.4	16.7	16.5	9.0	12.0	467	35	19	20	22/19	16	15	NA	385	2,073.2	368,100	370	515	494	1318.7	36.6	6.3	3.0	5.0	4.9
27	Mon	02/05/07	6:57 AM	2,649.7	2,621.2	17.8	18.8	17.0	12.0	569	32	20	21	21/22	12	11	NA	412	2,489.7	416,500	380	518	497	1373.2	54.5	3.0	2.0	2.3	1.8
	Tue	02/06/07	7:05 AM	2,664.1	2,636.1	14.4	14.9	5.0	9.0	350	33	18	22	18/24	15	11	NA	400	2,817.2	327,500	373	520	499	1403.6	30.4	4.0	1.7	5.3	0.9
	Wed	02/07/07	7:05 AM	2,678.8	2,650.1	14.7	14.0	0.0	7.0	181	35	17	20	18/21	18	15	NA	377	3,134.3	317,100	369	522	501	1442.9	39.3	5.1	2.6	4.8	4.9
	Thu	02/08/07	7:21 AM	2,692.2	2,665.3	13.4	15.2	0.0	9.0	NA	32	24	16	25/18	8	16	NA	383	192.4	NA	#VALUE!	525	503	1495.6	52.7	1.0	5.0	0.0	4.5
	Fri	02/09/07	8:15 AM	2,706.3	2,679.0	14.1	13.7	7.0	9.0	427	33	19	22	20/24	14	11	NA	405	498.9	306,500	368	526	505	1517.1	21.5	6.5	2.1	5.3	2.4
	Sat	02/10/07	7:45 AM	2,716.7	2,690.1	10.4	11.1	8.0	13.0	686	41	48	21	NA	NA	20	NA	260	749.3	250,400	389	527	506	1528.6	11.5	NR	4.2	0.0	6.3
	Sun	02/11/07	9:00 AM	2,731.8	2,704.9	15.1	14.8	10.0	20.0	733	33	17	20	NA	16	13	NA	380	1,084.0	334,700	373	529	508	1548.5	19.9	5.4	2.3	6.0	0.9
28	Mon	02/12/07	7:01 AM	2,751.4	2,725.2	19.6	20.3	2.0	2.0	128	38	21	15	27/12	17	23	NA	328	1,338.9	254,900	213	530	508	1554.5	6.0	3.2	22.5	0	1.1
	Tue	02/13/07	7:00 AM	2,770.9	2,744.3	19.5	19.1	2.0	2.0	204	35	16	17	18/12	19	18	NA	163	1,499.2	160,300	138	530	509	1557.8	3.3	22.6	17.6	2.6	25
	Wed	02/14/07	7:00 AM	2,791.4	2,764.5	20.5	20.2	0.0	0.0	0	33	14	18	15/20	19	15	NA	267	1,817.0	317,800	260	531	511	1568.7	10.9	19.2	6.9	2.4	2.1
	Thu	02/15/07	7:00 AM	2,814.1	2,786.7	22.7	22.2	0.0	0.0	0	32	14	17	15/20	18	15	NA	269	2,167.9	350,900	261	532	512	1599.7	31.0	22.6	6.9	0.5	0.0
	Fri	02/16/07	7:00 AM	2,834.7	2,807.1	20.6	20.4	0.0	0.0	0	30	15	16	15/19	15	14	NA	283	2,489.7	321,800	262	533	514	1601.7	2.0	19.9	8.6	2.5	1.4
	Sat	02/17/07	8:20 AM	2,851.3	2,823.8	16.6	16.7	0.0	0.0	0	26	15	18	15/20	11	8	NA	294	2,772.5	282,800	283	534	515	1616.9	15.2	12.7	8.3	3.3	3.3
	Sun	02/18/07	9:00 AM	2,869.8	2,842.1	18.5	18.3	0.0	0.0	0	24	16	19	16/21	8	5	NA	325	3,076.3	303,800	275	535	516	1633.5	16.6	11.2	0.1	5.1	0.0
29	Mon	02/19/07	7:00 AM	2,887.7	2,860.7	NA	NA	0.0	0.0	NA	32	17	14	18/15	15	18	NA	268	101.3	NA	#VALUE!	536	516	1640.8	NA	8.0	18.7	3.1	3.1
	Tue	02/20/07	11:45 AM	2,911.4	2,884.9	23.7	24.2	0.0	0.0	0	28	19	14	14	9	14	NA	294	520.4	419,100	292	538	518	1662.6	21.8	3.4	11.4	0.0	2.4
	Wed	02/21/07	7:15 AM	2,929.1	2,902.7	17.7	17.8	0.0	0.0	0	24	16	8	8	8	16	NA	322	815.5	295,100	277	539	519	1674.3	11.7	2.6	13.3	0.0	1.3
	Thu	02/22/07	6:50 AM	NR	NR	NR	NR	0.0	0.0	0	NR	NR	NR	NR	NR	NR	NA	NR	865.3	49,800	#VALUE!	NR	NR	NR	NA	NR	NR	NR	NR
	Fri	02/23/07	6:58 AM	2,963.6	2,937.0	NA	NA	0.0	0.0	0	28	14	19	15/21	14	9	NA	292	1,151.2	285,900	#VALUE!	540	521	1684.5	NA	13.1	2.7	6.7	4.7
	Sat	02/24/07	7:37 AM	2,977.7	2,951.5	14.1	14.5	0.0	0.0	0	30	16	14	15/15	14	16	NA	278	1,386.2	235,000	274	541	521	1689.1	4.6	9.2	17.2	7.2	14.0
	Sun	02/25/07	9:45 AM	2,995.1	2,968.3	17.4	16.8	0.0	0.0	0	23	15	19	15/20	8	4	NA	310	1,678.0	291,800	284	542	523	1702.7	13.6	9.2	0.3	7.6	0.0
30	Mon	02/26/07	6:49 AM	3,011.0	2,985.0	15.9	16.7	0.0	0.0	0	30	18	13	14/17	12	17	NA	272	1,925.8	247,800	254	543	523	1714.5	11.8	6.2	15.6	4.6	5.4
	Tue	02/27/07	6:56 AM	3,022.3	2,996.2	11.3	11.2	0.0	0.0	0	31	15	15	15/15	16	16	NA	265	2,154.4	228,600	339	544	524	1714.5	0.0	11.6	12.3	10.2	10.1
	Wed	02/28/07	7:18 AM	3,037.5	3,011.6	15.2	15.4	0.0	0.0	0	32	17	13	17/14	15	19	NA	269	2,409.9	255,500	278	545	525	1722.9	8.4	7.6	14.4	4.3	7.9
	Thu	03/01/07	7:05 AM	3,051.3	3,025.4	13.8	13.8	0.0	0.0	0	25	15	19	15/20	10	6	NA	309	2,655.4	245,500	296	546	527	1734.4	11.5	8.3	1.9	5.3	0.8
	Fri	03/02/07	7:00 AM	3,065.6	3,039.3	14.3	13.9	0.0	0.0	0	27	15	17	15/19	12	10	NA	287	2,901.4	246,000	291	547	528	1741.6	7.2	9.5	5.0	4.9	4.7
	Sat	03/03/07	7:15 AM	3,077.3	3,050.8	11.7	11.5	0.0	2.0	78	26	16	17	16/19	10	9	NA	315	3,110.7	209,300	301	548	529	1748.5	6.9	9.7	4.4	10.2	6.8
	Sun	03/04/07	7:10 AM	3,092.6	3,066.8	15.3	16.0	0.0	3.0	NA	25	19	15	20/15	6	10	NA	305	110.8	NA	#VALUE!	550	530	1759.0	10.5	2.7	4.5	6.0	6.9

Table A-1. US EPA Arsenic Demonstration Project at Arnaudville, LA - Daily System Operation Log Sheet (Continued)

											Pressure Filtration											Backwash				Since Last BW			
Week No.	Day of Week	Date	Time	Tank A Hour Meter hrs	Tank B Hour Meter hrs	TA Run Time hrs	TB Run Time hrs	$KMnO_4$ Tank 1 Level[(a)] inches	$KMnO_4$ Tank 2 Level (Iron) inches	Estimated $KMnO_4$ Dosage µg/L as Mn	Influent psig	Outlet Tank A psig	Outlet Tank B psig	Effluent psig	Inlet-TA psig	Inlet-TB psig	Inlet-Effluent psig	Flow rate gpm	Totalizer to Distribution kgal	Gallon Usage gal	Daily Average Flowrate gpm	Tank A No.	Tank B No.	Total Volume kgal	Daily Volume kgal	Run Time Tank A hrs	Run Time Tank B hrs	Standby Time Tank A hrs	Standby Time Tank B hrs
31	Mon	03/05/07	7:00 AM	3,108.1	3,081.8	15.5	15.0	NR	NR	NA	23	16	20	15	7	3	8	321	385.8	275,000	301	551	532	1769.5	10.5	7.3	0.2	5.5	0.0
	Tue	03/06/07	6:59 AM	3,122.6	3,095.8	14.5	14.0	NR	NR	NA	26	16	18	15	10	8	11	297	632.6	246,800	289	552	533	1776.8	7.3	9.9	3.7	8.5	5.9
	Wed	03/07/07	6:59 AM	3,163.3	3,110.1	NA	14.3	NR	NR	NA	23	21	15	15	2	8	8	300	880.5	247,900	#VALUE!	554	534	1787.3	10.5	0.1	7.5	0.0	4.9
	Thu	03/08/07	7:00 AM	3,150.3	3,124.1	NA	14.0	NR	NR	NA	26	19	15	15	7	11	11	301	1,129.1	248,600	#VALUE!	555	535	1794.1	6.8	3.8	9.3	5.5	6.5
	Fri	03/09/07	8:00 AM	3,167.6	3,141.0	17.3	16.9	NR	NR	NA	21	15	17	14	6	4	7	280	1,355.7	226,600	221	556	537	1804.2	10.1	10.4	5.6	3.5	3.5
	Sat	03/10/07	9:15 AM	3,183.3	3,157.2	15.7	16.2	NR	NR	NA	26	22	13	15	4	13	11	301	1,646.7	291,000	304	558	538	1814.9	10.7	0.8	10.8	0.0	7.5
	Sun	03/11/07	9:15 AM	3,200.3	3,174.4	17.0	17.2	NR	NR	NA	30	19	13	14	11	17	16	255	1,926.1	279,400	272	559	539	1822.8	7.9	4.8	13.1	6.0	6.0
32	Mon	03/12/07	7:00 AM	3,216.0	3,190.4	15.7	16.0	NR	NR	NA	32	17	13	14	15	19	18	265	2,181.7	255,600	269	560	540	1830.8	8.0	7.2	14.8	3.9	3.9
	Tue	03/13/07	7:00 AM	3,230.9	3,204.9	14.9	14.5	NR	NR	NA	32	17	13	14	15	19	18	251	2,420.0	238,300	270	561	541	1838.7	7.9	6.9	14.3	4.9	8.3
	Wed	03/14/07	7:22 AM	3,246.0	3,220.1	15.1	15.2	NR	NR	NA	31	18	13	14	13	18	17	263	2,668.1	248,100	273	562	542	1847.1	8.4	7.3	15.2	4.4	7.9
	Thu	03/15/07	7:01 AM	3,259.4	3,233.5	13.4	13.4	NR	NR	NA	31	19	14	14	12	17	17	275	2,893.0	224,900	280	563	543	1856.7	9.6	5.0	12.9	5.2	8.9
	Fri	03/16/07	7:00 AM	3,275.1	3,249.3	15.7	15.8	NR	NR	NA	30	18	14	14	12	16	16	275	3,149.3	256,300	271	564	544	1865.8	9.1	5.5	13.8	4.0	7.2
	Sat	03/17/07	7:40 AM	3,290.3	3,264.3	15.2	15.0	NR	NR	NA	31	18	14	18	13	17	13	252	124.7	NA	#VALUE!	565	545	1875.5	9.7	6.4	13.9	5.2	8.4
	Sun	03/18/07	NR	3,308.8	3,282.4	18.5	18.1	NR	NR	NA	28	15	20	15	13	8	13	297	428.5	303,800	277	566	547	1890.5	15.0	9.8	3.1	4.2	4.1
33	Mon	03/19/07	7:00 AM	3,328.4	3,302.4	19.6	20.0	NR	NR	NA	29	20	13	14	9	16	15	270	746.8	318,300	268	568	548	1903.9	13.4	3.8	11.5	1.5	1.5
	Tue	03/20/07	7:00 AM	3,343.1	3,317.0	14.7	14.6	NR	NR	NA	29	19	14	15	10	15	14	280	994.8	248,000	282	569	549	1913.0	9.1	4.9	4.1	12.6	7.2
	Wed	03/21/07	7:00 AM	3,358.3	3,332.3	15.2	15.3	NR	NR	NA	32	19	14	15	13	18	17	268	1,252.0	257,200	281	570	550	1922.1	9.1	6.0	13.7	4.1	7.6
	Thu	03/22/07	7:00 AM	3,373.1	3,346.9	14.8	14.6	NR	NR	NA	30	19	14	15	11	16	15	275	1,498.7	246,700	280	571	551	1931.2	9.1	6.6	19.2	5.8	8.1
	Fri	03/23/07	7:05 AM	3,388.3	3,362.1	15.2	15.2	NR	NR	NA	35	19	0	11	16	35	24	235	1,752.7	254,000	279	572	552	1940.8	9.6	7.2	0.0	4.3	0.0
	Sat	03/24/07	10:00 AM	3,407.3	3,381.3	19.0	19.2	NR	NR	NA	30	15	19	15	15	11	15	280	2,075.1	322,400	281	573	554	1955.2	14.4	11.1	4.8	4.6	2.5
	Sun	03/25/07	10:20 AM	3,424.4	3,398.2	17.1	16.9	NR	NR	NA	33	15	17	15	18	16	18	250	2,355.3	280,200	275	574	555	1964.9	9.7	14.1	7.6	5.9	5.9
34	Mon	03/26/07	7:05 AM	3,442.0	3,416.5	17.6	18.3	NR	NR	NA	29	21	13	15	8	16	14	280	2,651.8	296,500	275	576	556	1981.2	16.3	3.0	11.4	1.8	1.8
	Tue	03/27/07	6:55 AM	3,457.7	3,432.2	15.7	15.7	NR	NR	NA	26	15	22	15	11	4	11	310	2,924.6	272,800	290	577	558	1993.4	12.2	10.6	0.7	4.0	0.0
	Wed	03/28/07	7:05 AM	3,475.2	3,449.4	17.5	17.2	NR	NR	NA	29	15	19	15	14	10	14	295	3,206.1	281,500	270	578	559	2005.0	11.6	11.0	4.4	4.1	4.0
	Thu	03/29/07	7:05 AM	3,492.3	3,466.6	17.1	17.2	NR	NR	NA	29	16	18	15	13	11	14	285	211.2	NA	#VALUE!	579	560	2017.8	12.8	12.3	5.8	3.6	5.8
	Fri	03/30/07	7:21 AM	3,509.9	3,484.3	17.6	17.7	NR	NR	NA	31	15	18	14	16	13	17	275	501.5	290,300	274	580	561	2030.1	12.3	14.4	7.8	4.2	2.9
	Sat	03/31/07	9:00 AM	3,529.1	3,505.0	19.2	20.7	NR	NR	NA	29	22	14	15	7	15	14	292	836.5	335,000	280	582	562	2049.1	19.0	3.7	12.6	3.9	4.0
	Sun	04/01/07	9:20 AM	3,547.6	3,522.0	18.5	17.0	NR	NR	NA	32	20	14	15	12	18	17	270	1,135.7	299,200	281	583	563	2061.0	11.9	6.6	15.2	5.4	5.4
35	Mon	04/02/07	7:00 AM	3,567.8	3,542.0	20.2	20.0	NR	NR	NA	24	16	21	15	8	3	9	305	1,423.9	288,200	239	584	566	2085.0	24.0	84.0	0.9	0.0	0.0
	Tue	04/03/07	7:00 AM	3,586.8	3,561.1	19.0	19.1	NR	NR	NA	24	21	15	15	3	9	9	285	1,745.7	321,800	282	586	567	2102.2	17.2	2.4	8.5	3.3	3.8
	Wed	04/04/07	7:00 AM	3,603.5	3,578.2	16.7	17.1	NR	NR	NA	29	19	15	15	10	14	14	269	2,028.2	282,500	279	587	568	2110.9	8.7	6.2	13.4	3.7	4.8
	Thu	04/05/07	6:55 AM	3,620.1	3,594.5	16.6	16.3	NR	NR	NA	27	22	14	15	5	13	12	295	2,311.2	283,000	287	589	570	2127.8	16.9	1.6	7.2	0.3	3.0
	Fri	04/06/07	7:30 AM	3,634.6	3,608.6	14.5	14.1	NR	NR	NA	26	17	20	15	9	6	11	298	2,564.1	252,900	295	590	572	2138.9	11.1	6.6	2.1	5.1	3.0
	Sat	04/07/07	7:45 AM	3,650.6	3,625.1	16.0	16.5	NR	NR	NA	27	21	15	15	6	12	12	289	2,843.5	279,400	287	592	573	2149.2	10.3	2.0	8.3	3.2	6.0
	Sun	04/08/07	7:15 AM	3,666.7	3,640.4	16.1	15.3	NR	NR	NA	27	16	19	15	11	8	12	294	3,109.6	266,100	283	593	575	2159.1	9.9	8.0	3.4	5.9	5.9
36	Mon	04/09/07	7:00 AM	3,683.2	3,656.9	16.5	16.5	NR	NR	NA	24	17	21	16	7	3	8	314	111.7	NA	#VALUE!	595	577	2172.4	13.3	5.4	0.1	4.1	0.0
	Tue	04/10/07	7:15 AM	3,697.8	3,671.6	14.6	14.7	NR	NR	NA	29	17	18	15	12	11	14	290	365.6	253,900	289	596	578	2179.3	6.9	9.7	5.5	6.0	5.2
	Wed	04/11/07	7:20 AM	3,713.0	3,687.1	15.2	15.5	NR	NR	NA	36	21	2	14	15	NA	22	215	627.4	261,800	284	598	574	2191.8	12.5	5.1	5.3	0.0	0.0
	Thu	04/12/07	7:03 AM	3,728.8	3,702.9	15.8	15.8	NR	NR	NA	48	62	10	11	NA	38	37	0	892.9	265,500	280	599	581	2208.4	16.6	0.0	5.9	0.0	4.4
	Fri	04/13/07	NA	3,744.7	3,718.0	15.9	15.1	NR	NR	NA	26	16	21	15	10	5	11	308	1,162.1	269,200	290	601	583	2220.5	12.1	7.2	1.3	3.6	1.5
	Sat	04/14/07	10:00 AM	3,754.3	3,733.2	9.6	15.2	NR	NR	NA	29	17	18	15	12	11	14	297	1,471.4	309,300	438	602	585	2237.8	17.3	5.3	1.2	1.1	0.0
	Sun	04/15/07	9:30 AM	3,776.6	3,748.9	22.3	15.7	NR	NR	NA	28	15	19	15	13	9	13	277	1,698.0	226,600	205	604	587	2248.8	11.0	9.6	4.1	6.3	6.3
37	Mon	04/16/07	7:00 AM	3,791.5	3,764.4	14.9	15.5	NR	NR	NA	28	19	15	15	9	13	13	268	1,953.5	255,500	280	606	588	2260.9	12.1	4.0	10.3	3.9	4.6
	Tue	04/17/07	7:00 AM	3,809.9	3,781.9	18.4	17.5	NR	NR	NA	29	16	18	15	13	11	14	267	2,205.6	252,100	234	607	590	2273.6	12.7	11.9	4.6	1.1	1.0
	Wed	04/18/07	7:15 AM	3,825.3	3,797.7	15.4	15.8	NR	NR	NA	23	17	21	15	6	2	8	305	2,473.9	268,300	287	609	592	2290.3	16.7	5.3	0.1	4.3	0.0
	Thu	04/19/07	7:00 AM	3,840.0	3,812.7	14.7	15.0	NR	NR	NA	23	16	18	15	7	5	8	270	2,724.5	250,600	281	610	593	2299.1	8.8	9.7	5.1	4.0	4.0
	Fri	04/20/07	7:00 AM	3,853.5	3,827.4	13.5	14.7	NR	NR	NA	41	35	32	30	6	9	11	170	2,968.3	243,800	289	612	594	2312.2	13.1	3.7	9.4	4.7	5.5
	Sat	04/21/07	9:00 AM	3,871.1	3,844.3	17.6	16.9	NR	NR	NA	25	22	15	15	3	10	10	297	3,266.5	298,200	288	614	596	2328.0	15.8	0.9	6.5	0.0	4.7
	Sun	04/22/07	8:00 AM	3,887.3	3,859.9	16.2	15.6	NR	NR	NA	26	17	19	15	9	7	11	NR	260.3	NA	#VALUE!	615	598	2340.0	12.0	7.6	3.1	5.9	6.0
38	Mon	04/23/07	7:00 AM	3,907.1	3,879.8	19.8	19.9	NR	NR	NA	29	16	19	15	13	10	14	280	597.6	337,300	283	617	600	2355.4	15.4	8.3	4.2	1.7	1.7
	Tue	04/24/07	7:00 AM	3,922.9	3,896.4	15.8	16.6	NR	NR	NA	29	19	15	15	10	14	14	280	871.8	274,200	282	619	601	2367.2	11.8	4.5	9.8	3.6	3.6
	Wed	04/25/07	7:05 AM	3,938.3	3,911.0	15.4	14.6	NR	NR	NA	38	62	20	14	NA	18	24	380	1,131.7	259,900	289	620	603	2382.7	15.5	0.0	5.8	0.0	5.1
	Thu	04/26/07	7:02 AM	3,954.2	3,926.8	15.9	15.8	NR	NR	NA	27	17	20	15	10	7	12	300	1,403.7	272,000	286	622	605	2394.3	11.6	6.3	2.9	4.7	4.5
	Fri	04/27/07	7:00 AM	3,969.4	3,942.7	15.2	15.9	NR	NR	NA	27	20	16	15	7	11	12	290	1,666.2	262,500	281	624	606	2406.8	12.5	2.6	8.3	3.7	3.7
	Sat	04/28/07	7:05 AM	3,982.6	3,955.5	13.2	12.8	NR	NR	NA	25	17	21	15	8	4	10	304	1,891.9	225,700	289	624	608	2418.1	11.3	6.0	7.1	6.1	2.8
	Sun	04/29/07	7:05 AM	3,999.9	3,972.0	17.3	16.5	NR	NR	NA	24	17	19	15	7	5	9	305	2,192.1	300,200	296	627	610	2434.1	16.0	5.8	2.3	5.0	5.0
39	Mon	04/30/07	7:00 AM	4,018.6	3,991.6	18.7	19.6	NR	NR	NA	24	16	18	15	8	6	9	294	2,515.1	323,000	281	628	611	2446.4	12.3	13.1	7.4	4.2	4.2
	Tue	05/01/07	7:10 AM	4,036.1	4,009.8	17.5	18.2	NR	NR	NA	26	21	15	15	5	11	11	285	2,814.5	299,400	280	630	612	2469.3	22.9	2.7	9.7	2.2	2.2
	Wed	05/02/07	7:00 AM	4,052.5	4,027.0	16.4	17.2	NR	NR	NA	23	20	17	15	3	6	8	291	3,089.0	274,500	272	631	613	2481.8	12.5	2.5	12.5	2.7	3.3
	Thu	05/03/07	7:00 AM	4,068.5	4,043.0	16.0	16.0	NR	NR	NA	19	14	10	15	5	9	4	320	78.0	NA	#VALUE!	632	614	2498.0	16.2	3.3	9.5	3.1	3.0
	Fri	05/04/07	7:00 AM	4,084.4	4,059.1	15.9	16.1	NR	NR	NA	18	12	11	15	6	7	3	290	349.6	271,600	283	633	615	2508.2	10.2	4.8	12.1	4.8	6.9
	Sat	05/05/07	7:10 AM	4,099.8	4,074.4	15.4	15.3	NR	NR	NA	27	22	15	15	5	12	12	280	603.2	253,600	275	634	616	2518.6	10.4	4.0	13.3	5.2	7.3
	Sun	05/06/07	6:50 AM	4,117.4	4,090.9	17.6	16.5	NR	NR	NA	24	18	20	15	6	4	9	295	880.7	277,500	272	635	618	2532.5	13.9	7.7	2.3	4.5	4.4
40	Mon	05/07/07	6:55 AM	4,135.2	4,110.1	17.8	19.2	NR	NR	NA	28	20	16	15	8	12	13	286	1,184.5	303,800	274	637	619	2544.6	12.1	4.8	11.1	3.3	3.3
	Tue	05/08/07	7:00 AM	4,151.8	4,126.0	16.6	15.9	NR	NR	NA	28	16	20	15	12	8	13	260	1,456.0	271,500	279	638	621	2556.1	11.5	9.8	4.8	3.6	3.6
	Wed	05/09/07	7:00 AM	4,169.5	4,143.7	17.7	17.7	NR	NR	NA	28	16	19	15	12	9	13	275	1,740.0	284,000	267	639	622	2565.6	9.5	17.4	8.1	5.0	3.1
	Thu	05/10/07	7:00 AM	4,186.6	4,161.5	17.1	17.8	NR	NR	NA	28	20	17	15	8	11	13	265	2,022.3	282,300	270	641	623	2585.8	20.2	4.6	10.3	3.7	3.8
	Fri	05/11/07	7:00 AM	4,204.3	4,179.2	17.7	17.7	NR	NR	NA	24	23	16	15	1	8	9	302	2,307.8	285,500	269	643	625	2602.0	16.2	0.0	6.8	0.0	2.0
	Sat	05/12/07	4:00 PM	4,236.2	4,203.1	31.9	23.9	NR	NR	NA	28	22	16	15	6	12	13	280	2,582.6	274,800	168	644	627	2615.0	13.0	4.5	0.0	5.0	3.7
	Sun	05/13/07	9:00 AM	4,240.5	4,215.0	4.3	11.9	NR	NR	NA	26	17	22	15	9	4	11	265	2,890.4	307,800	812	646	629	2627.5	12.5	7.2	1.6	4.0	0.0
41	Mon	05/14/07	7:00 AM	4,258.6	4,233.1	18.1	18.1	NR	NR	NA	25	17	22	15	8	3	10	305	3,187.1	296,700	273	648	631	2641.9	14.4	5.6	0.2	2.1	0.0
	Tue	05/15/07	7:00 AM	4,275.5	4,250.8	16.9	17.7	NR	NR	NA	28	21	16	15	7	12	13	260	184.7	NA	#VALUE!	650	632	2652.6	10.7	2.9	8.6	5.2	5.3
	Wed	05/16/07	6:50 AM	4,291.8	4,266.5	16.3	15.7	NR	NR	NA	31	16	19	15	15	12	16	265	443.5	258,800	270	651	634	2663.0	10.4	10.3	5.9	4.1	4.1
	Thu	05/17/07	8:00 AM	4,309.5	4,284.3	17.7	17.8	NR	NR	NA	26	17	22	14	9	4	12	302	735.2	291,700	274	653	636	2678.2	15.2	7.1	1.1	2.4	0.0
	Fri	05/18/07	7:30 AM	4,328.3	4,303.6	18.8	19.3	NR	NR	NA	25	18	23	15	7	2	10	298	1,045.6	310,400	272	655	638	2693.8	15.6	1.3	3.4	0.0	1.3
	Sat	05/19/07	7:15 AM	4,342.1	4,317.3	13.8	13.7	NR	NR	NA	29	19	16	15	10	13	14	271	1,279.0	233,400	283	656	638	2698.7	4.9	3.5	11.2	5.1	5.1
	Sun	05/20/07	7:00 AM	4,362.3	4,337.5	20.2	20.2	NR	NR	NA	26	20	15	15	6	11	11	289	1,647.3	368,300	304	659	641	2719.0	20.3	2.5	7.7	1.4	1.4
42	Mon	05/21/07	7:15 AM	4,379.2	4,354.6	16.9	17.1	NR	NR	NA	31	26	17	15	5	14	16	470	2,048.8	401,500	394	664	646	2752.8	33.8	0.2	1.9	0.0	3.0
	Tue	05/22/07	7:05 AM	4,394.0	4,369.4	14.8	14.8	NR	NR	NA	32	21	14	15	11	18	17	298	2,368.8	320,000	360	666	648	2766.9	14.1	4.8	12.5	3.9	5.8
	Wed	05/23/07	7:00 AM	4,410.1	4,384.6	16.1	15.2	NR	NR	NA	37	15	15	15	22	22	22	200	2,614.6	245,800	262	666	649	2770.8	3.9	20.8	15.2	11.3	7.3
	Thu	05/24/07	7:00 AM	4,425.0	4,399.4	14.9	14.8	NR	NR	NA	29	18	16	15	11	13	14	280	2,876.9	262,300	294	667	650	2779.8	9.0	11.7	13.7	8.1	8.1
	Fri	05/25/07	7:00 AM	4,437.5	4,411.8	12.5	12.4	NR	NR	NA	7	12	10	11	NA	NA	NA	0	3,139.3	262,400	351	669	652	2794.7	14.9	2.6	3.1	6.4	6.3
	Sat	05/26/07	8:45 AM	4,453.4	4,427.7	15.9	15.9	NR	NR	NA	7	12	10	11	NA	NA	NA	0	15.3	NA	#VALUE!	670	653	2803.8	9.1	4.2	15.0	4.1	7.8
	Sun	05/27/07	8:35 AM	4,470.8	4,444.2	17.4	16.5	NR	NR	NA	29	17	18	15	12	11	14	265	445.0	429,700	423	670	654	2811.1	7.3	21.6	10.3	10.3	6.0

Table A-1. US EPA Arsenic Demonstration Project at Arnaudville, LA - Daily System Operation Log Sheet (Continued)

Week No.	Day of Week	Date	Time	Tank A Hour Meter hrs	Tank B Hour Meter hrs	TA Run Time hrs	TB Run Time hrs	$KMnO_4$ Tank 1 Level[a] inches	$KMnO_4$ Tank 2 Level (Iron) inches	Estimated $KMnO_4$ Dosage µg/L as Mn	Pressure Filtration: Influent psig	Outlet Tank A psig	Outlet Tank B psig	Effluent psig	Inlet-TA psig	Inlet-TB psig	Inlet-Effluent psig	Flow rate gpm	Totalizer to Distribution kgal	Gallon Usage gal	Daily Average Flowrate gpm	Backwash: Tank A No.	Tank B No.	Total Volume kgal	Daily Volume kgal	Since Last BW: Run Time Tank A hrs	Run Time Tank B hrs	Standby Time Tank A hrs	Standby Time Tank B hrs
	Mon	05/28/07	9:00 AM	4,490.9	4,464.6	20.1	20.4	NR	NR	NA	26	23	15	15	3	11	11	298	785.7	340,700	280	672	656	2833.2	22.1	2.6	11.8	0.9	3.3
	Tue	05/29/07	7:05 AM	4,507.9	4,481.5	17.0	16.9	NR	NR	NA	7	13	11	15	NA	NA	NA	0	1,072.1	286,400	282	673	656	2842.0	8.8	5.1	14.3	3.7	3.7
	Wed	05/30/07	7:00 AM	4,523.0	4,496.5	15.1	15.0	NR	NR	NA	27	21	15	15	6	12	12	295	1,329.3	257,200	285	674	657	2848.9	6.9	5.0	13.2	4.2	7.2
43	Thu	05/31/07	9:00 AM	4,535.5	4,508.8	12.5	12.3	NR	NR	NA	40	37	34	15	3	6	25	200	1,629.0	299,700	403	676	659	2862.7	13.8	1.7	5.2	0.8	6.1
	Fri	06/01/07	7:40 AM	4,545.4	4,518.6	9.9	9.8	NR	NR	NA	32	21	16	15	11	16	17	433	1,887.5	258,500	437	677	661	2873.2	10.5	5.5	2.1	8.1	5.3
	Sat	06/02/07	9:10 AM	4,557.3	4,530.6	11.9	12.0	NR	NR	NA	39	24	60	13	15	NA	26	400	2,182.8	295,300	412	679	662	2887.6	14.4	4.0	0.0	7.5	0.0
	Sun	06/03/07	9:15 AM	4,570.9	4,543.8	13.6	13.2	NR	NR	NA	38	2	26	14	NA	12	24	275	2,504.3	321,500	400	680	664	2895.7	8.1	0.0	6.1	0.0	7.0
	Mon	06/04/07	7:00 AM	4,582.0	4,554.9	11.1	11.1	NR	NR	NA	7	12	10	10	NA	NA	NA	0	2,785.7	281,400	423	681	665	2908.3	12.6	11.6	6.3	8.1	6.8
	Tue	06/05/07	6:55 AM	4,592.1	4,565.3	10.1	10.4	NR	NR	NA	39	24	0	14	15	39	25	251	2,929.3	143,600	234	683	666	3054.8	146.5	3.1	0.0	6.7	0.0
	Wed	06/06/07	7:05 AM	4,603.4	4,576.6	11.3	11.3	NR	NR	NA	7	12	10	10	NA	NA	NA	0	63.6	NA	#VALUE!	685	668	2944.7	NA	0.8	4.9	0.6	7.1
44	Thu	06/07/07	7:05 AM	4,614.8	4,587.7	11.4	11.1	NR	NR	NA	34	19	24	15	15	10	19	409	346.9	283,300	420	686	670	2954.2	9.5	6.4	2.9	5.6	5.6
	Fri	06/08/07	7:05 AM	4,626.9	4,599.7	12.1	12.0	NR	NR	NA	7	11	10	10	NA	NA	NA	0	652.4	305,500	423	688	672	2968.3	14.1	5.6	0.4	4.7	0.0
	Sat	06/09/07	7:10 AM	4,636.6	4,609.6	9.7	9.9	NR	NR	NA	6	12	10	10	NA	NA	NA	0	910.5	258,100	439	690	673	2978.9	10.6	2.2	4.4	7.1	8.1
	Sun	06/10/07	7:05 AM	4,650.1	4,622.7	13.5	13.1	NR	NR	NA	32	25	21	15	7	11	17	436	1,246.7	336,200	421	692	675	2992.8	13.9	2.4	5.3	6.2	7.1
	Mon	06/11/07	6:55 AM	4,664.8	4,637.3	14.7	14.6	NR	NR	NA	31	21	27	17	10	4	14	445	1,614.2	367,500	418	694	678	3000.0	7.2	4.0	0.8	5.8	0.9
	Tue	06/12/07	7:00 AM	4,677.5	4,649.9	12.7	12.6	NR	NR	NA	37	1	30	15	NA	7	22	340	1,929.1	314,900	415	696	680	3023.8	23.8	0.0	1.1	0.0	0.5
	Wed	06/13/07	7:00 AM	4,689.6	4,662.3	12.1	12.4	NR	NR	NA	32	24	21	15	8	11	17	427	2,245.9	316,800	431	698	681	3034.2	10.4	4.9	7.7	4.9	4.9
45	Thu	06/14/07	7:00 AM	4,702.6	4,674.8	13.0	12.5	NR	NR	NA	40	22	6	12	18	34	28	235	2,568.8	322,900	422	700	683	3048.1	13.9	3.3	0.0	5.0	0.0
	Fri	06/15/07	7:05 AM	4,713.8	4,685.6	11.2	10.8	NR	NR	NA	40	34	38	40	6	2	0	223	2,853.8	285,000	432	702	686	3065.3	17.2	5.4	1.0	6.2	0.0
	Sat	06/16/07	8:50 AM	4,725.6	4,697.4	11.8	11.8	NR	NR	NA	33	18	28	12	15	5	21	429	3,177.3	323,500	457	704	688	3079.2	13.9	5.3	0.8	6.8	0.0
	Sun	06/17/07	1:00 AM	4,740.4	4,713.1	14.8	15.7	NR	NR	NA	33	27	22	18	6	11	15	475	296.8	NA	#VALUE!	707	690	3097.4	18.2	1.0	4.1	0.8	1.3
	Mon	06/18/07	7:30 AM	4,750.3	4,722.9	9.9	9.8	NR	NR	NA	39	24	0	30	15	39	9	267	542.5	245,700	416	708	691	3104.3	6.9	3.4	0.0	6.0	0.0
	Tue	06/19/07	7:05 AM	4,761.1	4,733.6	10.8	10.7	NR	NR	NA	31	29	20	29	2	11	2	476	815.9	273,400	424	710	693	3119.2	14.9	0.0	5.3	0.0	6.0
	Wed	06/20/07	7:05 AM	4,771.0	4,743.2	9.9	9.6	NR	NR	NA	31	22	26	28	9	5	3	455	1,074.4	258,500	442	711	695	3129.5	10.3	3.8	1.4	6.9	4.0
46	Thu	06/21/07	7:13 AM	4,782.3	4,754.6	11.3	11.4	NR	NR	NA	33	20	25	27	13	8	6	435	1,364.3	289,900	426	712	696	3136.8	7.3	8.9	4.1	10.0	6.4
	Fri	06/22/07	7:10 AM	4,795.1	4,768.3	12.8	13.7	NR	NR	NA	33	21	19	27	12	14	6	380	1,666.0	301,700	380	714	697	3155.1	18.3	4.1	7.4	6.1	6.0
	Sat	06/23/07	8:55 AM	4,809.0	4,789.2	13.9	20.9	NR	NR	NA	32	28	17	27	4	15	5	400	1,999.1	333,100	333	716	699	3170.0	14.9	1.3	7.2	0.0	6.3
	Sun	06/24/07	11:00 AM	4,822.7	4,795.5	13.7	6.3	NR	NR	NA	31	19	24	25	12	7	6	400	2,324.2	325,100	628	717	701	3181.4	11.4	6.9	2.8	7.2	2.7
	Mon	06/25/07	7:00 AM	4,833.1	4,806.3	10.4	10.8	NR	NR	NA	30	27	18	16	3	12	14	410	2,586.8	262,600	413	719	702	3192.6	11.2	0.9	5.7	0.2	6.5
	Tue	06/26/07	7:00 AM	4,844.7	4,818.0	11.6	11.7	NR	NR	NA	6	12	11	11	NA	NA	NA	0	2,864.2	277,400	397	720	704	3203.2	10.6	9.1	0.9	6.3	0.4
	Wed	06/27/07	7:00 AM	4,856.3	4,829.7	11.6	11.7	NR	NR	NA	32	19	23	15	13	9	17	385	3,140.2	276,000	395	721	705	3211.3	8.1	7.8	4.4	6.7	5.2
47	Thu	06/28/07	7:15 AM	4,867.2	4,840.1	10.9	10.4	NR	NR	NA	33	19	22	15	14	11	18	370	123.1	NA	#VALUE!	722	706	3218.9	7.6	9.9	6.0	10.8	7.5
	Fri	06/29/07	7:00 AM	4,878.9	4,851.9	11.7	11.8	NR	NR	NA	32	23	19	16	9	13	16	390	398.3	275,200	390	724	707	3239.5	20.6	5.8	7.8	0.3	8.6
	Sat	06/30/07	7:00 AM	4,890.2	4,862.6	11.3	10.7	NR	NR	NA	6	11	12	11	NA	NA	NA	0	657.2	258,900	393	725	709	3245.9	6.4	7.7	2.1	9.2	5.6
	Sun	07/01/07	7:00 AM	4,900.0	4,873.4	9.8	10.8	NR	NR	NA	29	28	20	15	1	9	14	429	914.6	257,400	417	727	710	3257.8	11.9	0.0	5.6	0.0	9.0
	Mon	07/02/07	7:00 AM	4,911.7	4,885.3	11.7	11.9	NR	NR	NA	30	25	20	16	5	10	14	416	1,198.6	284,000	401	728	711	3265.3	7.5	2.3	6.2	8.3	8.9
	Tue	07/03/07	7:00 AM	4,923.3	4,896.7	11.6	11.4	NR	NR	NA	29	21	27	16	8	2	13	451	1,469.1	270,500	392	729	713	3276.2	10.9	5.3	0.0	5.7	0.0
	Wed	07/04/07	7:05 AM	4,933.7	4,907.1	10.4	10.4	NR	NR	NA	29	21	27	16	8	2	13	432	1,713.3	244,200	391	730	714	7.0	NA	6.3	0.0	6.8	0.0
48	Thu	07/05/07	7:05 AM	4,944.6	4,918.1	10.9	11.0	NR	NR	NA	6	11	6	15	NA	NA	NA	0	1,986.4	273,100	416	731	715	14.6	7.6	7.9	2.0	9.9	6.2
	Fri	07/06/07	6:57 AM	4,954.6	4,929.1	10.0	11.0	NR	NR	NA	6	12	6	10	NA	NA	NA	0	2,241.0	254,600	405	733	716	25.5	10.9	0.7	8.8	1.7	9.3
	Sat	07/07/07	10:00 AM	4,965.3	4,940.6	10.7	11.5	NR	NR	NA	32	21	14	15	11	18	17	439	2,491.6	250,600	377	734	715	34.1	8.6	4.8	12.5	3.9	5.8
	Sun	07/08/07	9:15 AM	4,976.9	4,950.2	11.6	9.6	NR	NR	NA	29	22	27	17	7	2	12	456	2,781.7	290,100	460	735	719	43.7	9.6	4.6	0.3	8.7	0.0
	Mon	07/09/07	NR	NR	NR	NA	NA	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	NR	NA	#VALUE!	NR	NR	NR	NA	NR	NR	NR	NR
	Tue	07/10/07	7:00 AM	5,003.5	4,962.1	26.6	11.9	NR	NR	NA	46	3	1	11	43	NA	NA	0	34.0	NA	#VALUE!	739	720	62.3	18.6	0.0	1.2	0.0	1.8
	Wed	07/11/07	7:00 AM	5,019.1	4,962.1	15.6	0.0	NR	NR	NA	39	24	0	12	15	39	27	262	297.2	263,200	#DIV/0!	741	720	70.0	NA	9.0	1.2	4.1	1.8
49	Thu	07/12/07	7:00 AM	5,034.6	4,962.1	15.5	0.0	NR	NR	NA	38	25	0	15	13	38	23	260	568.3	271,100	#DIV/0!	744	720	84.2	14.2	4.0	1.2	4.0	1.8
	Fri	07/13/07	7:05 AM	5,050.9	4,962.1	16.3	0.0	NR	NR	NA	46	47	0	10	NA	46	36	0	842.8	274,500	#DIV/0!	747	720	96.0	11.8	0.0	0.0	9.2	1.8
	Sat	07/14/07	10:00 AM	5,070.0	4,962.1	19.1	0.0	NR	NR	NA	38	25	0	15	13	38	23	262	1,174.7	331,900	#DIV/0!	751	720	109.5	13.5	3.7	1.2	2.1	1.8
	Sun	07/15/07	9:30 AM	5,083.4	4,962.1	13.4	0.0	NR	NR	NA	40	33	0	29	7	40	11	175	1,407.1	232,400	#DIV/0!	754	720	119.9	10.4	3.0	1.2	2.3	1.8
	Mon	07/16/07	7:10 AM	5,097.7	4,962.1	14.3	0.0	NR	NR	NA	38	23	0	14	15	38	24	267	1,647.0	239,900	#DIV/0!	757	720	130.7	10.8	4.0	1.2	3.9	1.8
	Tue	07/17/07	7:25 AM	5,112.4	4,962.1	14.7	0.0	NR	NR	NA	37	27	0	15	10	37	22	283	1,907.3	260,300	#DIV/0!	761	720	145.2	14.5	2.4	1.2	3.5	1.8
	Wed	07/18/07	10:00 AM	5,129.5	4,962.1	17.1	0.0	NR	NR	NA	36	29	0	14	7	36	22	305	2,187.2	279,900	#DIV/0!	765	720	159.8	14.6	1.9	1.2	0.0	1.8
50	Thu	07/19/07	7:10 AM	5,140.7	4,969.8	11.2	7.7	NR	NR	NA	32	24	19	16	8	13	16	402	2,448.0	260,800	476	767	722	173.8	14.0	2.8	7.7	6.2	7.3
	Fri	07/20/07	7:00 AM	5,151.6	4,981.2	10.9	11.4	NR	NR	NA	30	29	19	15	1	11	15	414	2,713.2	265,200	397	769	723	184.6	10.8	0.1	10.1	0.0	9.6
	Sat	07/21/07	7:10 AM	5,161.7	4,991.4	10.1	10.2	NR	NR	NA	31	25	20	15	6	11	16	410	2,959.8	246,600	405	770	724	191.7	7.1	3.1	9.2	6.8	11.5
	Sun	07/22/07	7:00 AM	5,174.5	5,004.1	12.8	12.7	NR	NR	NA	32	20	25	16	12	7	16	415	3,262.7	302,900	396	771	726	201.8	10.1	8.3	3.7	7.5	4.4
	Mon	07/23/07	7:10 AM	5,186.4	5,016.7	11.9	12.6	NR	NR	NA	33	24	20	17	9	13	16	400	292.1	NA	#VALUE!	773	727	212.5	10.7	3.5	7.3	6.4	7.8
	Tue	07/24/07	7:10 AM	5,198.5	5,028.6	12.1	11.9	NR	NR	NA	33	21	19	18	12	14	15	386	587.3	295,200	410	775	729	224.8	12.3	0.0	5.6	0.0	9.0
	Wed	07/25/07	7:05 AM	5,210.9	5,040.5	12.4	11.9	NR	NR	NA	33	18	25	16	15	8	17	374	882.0	294,700	404	776	731	237.0	12.2	8.4	2.2	8.9	5.5
51	Thu	07/26/07	NR	5,222.5	5,052.6	11.6	12.1	NR	NR	NA	32	26	17	15	6	15	17	416	1,169.4	287,400	404	778	732	249.6	12.6	0.1	5.8	0.0	7.2
	Fri	07/27/07	NR	5,234.7	5,065.1	12.2	12.5	NR	NR	NA	29	28	20	18	1	9	11	447	1,457.4	288,000	389	780	734	262.6	13.0	0.2	4.7	0.0	5.0
	Sat	07/28/07	11:00 AM	5,247.4	5,077.6	12.7	12.5	NR	NR	NA	32	18	26	16	14	6	16	404	1,757.5	300,100	397	781	736	273.5	10.9	6.3	2.4	6.9	0.0
	Sun	07/29/07	1:00 AM	5,258.5	5,089.5	11.1	11.9	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	2,052.5	295,000	428	783	738	288.2	14.7	3.1	0.8	1.0	8.1
	Mon	07/30/07	7:30 AM	5,266.5	5,097.8	8.0	8.3	NR	NR	NA	39	24	3	14	15	36	25	276	2,243.6	191,100	391	784	738	291.9	3.7	4.2	0.0	5.4	0.0
	Tue	07/31/07	7:45 AM	5,278.7	5,109.6	12.2	11.8	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	2,534.3	290,700	404	786	740	307.1	15.2	1.0	5.0	0.0	6.8
	Wed	08/01/07	7:00 AM	5,289.2	5,119.3	10.5	9.7	NR	NR	NA	38	24	1	14	14	37	24	260	2,780.4	246,100	407	787	741	314.2	7.1	3.5	0.0	6.6	0.0
52	Thu	08/02/07	7:10 AM	5,300.7	5,130.5	11.5	11.2	NR	NR	NA	32	19	24	15	13	8	17	388	3,048.9	268,500	394	788	743	326.6	12.4	8.2	3.8	7.5	5.2
	Fri	08/03/07	7:00 AM	5,310.7	5,140.7	10.0	10.2	NR	NR	NA	31	24	21	17	7	10	14	422	30.3	NA	#VALUE!	790	744	338.8	12.2	2.5	5.6	6.0	7.3
	Sat	08/04/07	10:00 AM	5,324.8	5,155.5	14.1	14.8	NR	NR	NA	31	28	19	17	3	12	14	413	363.7	333,400	385	792	746	376.6	37.8	1.1	5.2	0.0	6.3
	Sun	08/05/07	NR	NR	NR	NA	NA	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	NR	NA	#VALUE!	NR	NR	NR	NA	NR	NR	NR	NR
	Mon	08/06/07	7:20 AM	5,349.0	5,179.7	NA	NA	NR	NR	NA	40	40	40	50	NA	NA	NA	204	952.8	589,100	#VALUE!	794	749	391.7	NA	7.8	2.7	6.5	4.7
	Tue	08/07/07	7:30 AM	5,361.5	5,191.6	12.5	11.9	NR	NR	NA	30	23	25	27	7	5	3	444	1,251.9	299,100	409	795	750	410.2	18.5	7.0	3.9	6.7	6.8
	Wed	08/08/07	7:30 AM	5,374.0	5,204.3	12.5	12.7	NR	NR	NA	29	28	21	17	1	8	12	447	1,555.5	303,600	402	797	751	438.7	28.5	0.2	4.7	0.0	5.0
53	Thu	08/09/07	7:05 AM	5,386.6	5,216.6	12.6	12.3	NR	NR	NA	33	20	22	16	13	11	17	379	1,859.2	303,700	407	798	753	453.4	14.7	7.1	4.5	5.7	5.7
	Fri	08/10/07	7:05 AM	5,400.1	5,230.5	13.5	13.9	NR	NR	NA	38	26	2	14	12	NA	24	285	2,181.4	322,200	392	800	754	468.3	14.9	4.4	0.0	4.1	0.0
	Sat	08/11/07	7:10 AM	5,412.8	5,242.7	12.7	12.2	NR	NR	NA	32	20	25	15	12	7	17	415	2,482.3	300,900	403	801	756	479.8	11.5	8.1	3.4	6.3	5.2
	Sun	08/12/07	7:25 AM	5,425.7	5,256.0	12.9	13.3	NR	NR	NA	30	27	21	16	3	9	14	427	2,791.7	309,400	394	803	757	491.9	12.1	1.5	7.6	5.2	7.2

Table A-1. US EPA Arsenic Demonstration Project at Arnaudville, LA - Daily System Operation Log Sheet (Continued)

											Pressure Filtration											Backwash				Since Last BW			
Week No.	Day of Week	Date	Time	Tank A Hour Meter hrs	Tank B Hour Meter hrs	TA Run Time hrs	TB Run Time hrs	$KMnO_4$ Tank 1 Level[(a)] inches	$KMnO_4$ Tank 2 Level (Iron) inches	Estimated $KMnO_4$ Dosage µg/L as Mn	Influent psig	Outlet Tank A psig	Outlet Tank B psig	Effluent psig	Inlet-TA psig	Inlet-TB psig	Inlet-Effluent psig	Flow rate gpm	Totalizer to Distribution kgal	Gallon Usage gal	Daily Average Flowrate gpm	Tank A No.	Tank B No.	Total Volume kgal	Daily Volume kgal	Run Time Tank A hrs	Run Time Tank B hrs	Standby Time Tank A hrs	Standby Time Tank B hrs
54	Mon	08/13/07	6:55 AM	5,440.5	5,270.5	14.8	14.5	NR	NR	NA	32	21	24	17	11	8	15	399	3,138.3	656,000	746	804	759	503.0	11.1	8.0	4.8	5.6	5.2
	Tue	08/14/07	6:55 AM	5,451.9	5,282.5	11.4	12.0	NR	NR	NA	32	26	20	16	6	12	16	404	153.3	NA	#VALUE!	806	760	515.8	12.8	3.2	7.1	5.9	6.6
	Wed	08/15/07	7:05 AM	5,471.0	5,301.6	19.1	19.1	NR	NR	NA	27	21	14	15	6	13	12	244	453.8	300,500	262	807	761	533.7	17.9	3.8	17.6	0.9	3.5
	Thu	08/16/07	7:05 AM	5,483.8	5,313.1	12.8	11.5	NR	NR	NA	33	20	29	15	13	4	18	494	749.6	295,800	407	808	764	552.5	18.8	6.2	0.0	6.7	0.0
	Fri	08/17/07	7:05 AM	5,500.9	5,330.4	17.1	17.3	NR	NR	NA	25	15	20	13	10	5	12	273	1,047.0	297,400	288	810	766	567.5	15.0	13.3	3.3	4.5	3.8
	Sat	08/18/07	10:00 AM	5,512.4	5,342.9	11.5	12.5	NR	NR	NA	32	29	19	17	3	13	15	404	1,339.5	292,500	407	812	767	578.3	10.8	1.0	5.7	0.0	8.0
	Sun	08/19/07	10:00 AM	5,526.0	5,355.6	13.6	12.7	NR	NR	NA	31	21	27	16	10	4	15	418	1,639.4	299,900	381	813	769	588.7	10.4	4.7	0.8	6.8	0.0
55	Mon	08/20/07	7:15 AM	5,538.1	5,367.4	12.1	11.8	NR	NR	NA	32	20	25	15	12	7	17	428	1,921.1	581,600	811	815	770	596.7	8.0	8.0	3.1	6.0	4.8
	Tue	08/21/07	7:10 AM	5,549.3	5,379.6	11.2	12.2	NR	NR	NA	32	25	19	16	7	13	16	379	2,192.1	271,000	387	816	771	606.4	9.7	3.9	8.1	5.1	6.4
	Wed	08/22/07	7:30 AM	5,561.4	5,391.2	12.1	11.6	NR	NR	NA	32	18	26	16	14	6	16	404	2,474.1	282,000	397	817	773	617.3	10.9	6.0	4.4	6.0	6.1
	Thu	08/23/07	7:14 AM	5,574.0	5,404.2	12.6	13.0	NR	NR	NA	33	24	20	17	9	13	16	400	2,785.1	311,000	405	819	775	628.1	10.8	4.3	1.1	5.9	0.0
	Fri	08/24/07	7:10 AM	5,585.8	5,416.7	11.8	12.5	NR	NR	NA	30	29	19	18	NA	11	12	412	3,066.8	281,700	387	821	776	641.8	13.7	0.1	5.6	0.0	5.7
	Sat	08/25/07	7:30 AM	5,596.9	5,427.8	11.1	11.1	NR	NR	NA	33	25	19	17	8	14	16	318	47.5	NA	#VALUE!	822	777	648.8	7.0	3.1	8.2	7.3	9.1
	Sun	08/26/07	7:00 AM	5,610.4	5,440.9	13.5	13.1	NR	NR	NA	33	20	24	16	13	9	17	370	351.3	303,800	381	823	779	659.2	10.4	8.8	4.2	7.3	6.1
56	Mon	08/27/07	7:30 AM	5,624.6	5,454.4	14.2	13.5	NR	NR	NA	31	21	28	16	10	3	15	407	664.6	617,100	743	825	781	673.2	14.0	5.4	0.2	5.4	0.0
	Tue	08/28/07	6:55 AM	5,634.9	5,464.4	10.3	10.0	NR	NR	NA	30	23	28	16	7	2	14	425	899.0	234,400	385	826	782	681.3	8.1	7.0	0.0	7.3	0.0
	Wed	08/29/07	7:00 AM	5,646.5	5,475.9	11.6	11.5	NR	NR	NA	31	23	25	16	8	6	15	407	1,161.9	262,900	379	827	783	690.4	9.1	6.5	2.7	7.5	6.3
	Thu	08/30/07	7:03 AM	5,657.7	5,487.0	11.2	11.1	NR	NR	NA	32	20	22	16	12	10	16	NR	1,416.1	254,200	380	828	784	703.7	13.3	6.4	4.1	6.0	5.9
	Fri	08/31/07	7:00 AM	5,678.0	5,507.5	20.3	20.5	NR	NR	NA	27	18	13	14	9	14	13	NR	1,587.5	171,400	140	829	785	720.3	16.6	5.9	14.3	0.0	0.0
	Sat	09/01/07	9:30 AM	5,696.6	5,525.3	18.6	17.8	NR	NR	NA	22	15	20	13	7	2	9	NR	1,587.9	400	0	830	787	733.6	13.3	1.0	1.9	3.5	0.0
	Sun	09/02/07	10:00 AM	5,717.0	5,545.9	20.4	20.6	NR	NR	NA	23	16	20	13	7	3	10	NR	NR	NA	#VALUE!	831	788	743.0	9.4	11.9	1.5	4.0	0.0
57	Mon	09/03/07	NR	5,735.2	5,563.7	18.2	17.8	NR	NR	NA	15	21	14	NR	NA	NA	NA	NR	NR	NA	#VALUE!	832	787	751.0	8.0	5.9	11.2	0.0	0.0
	Tue	09/04/07	7:10 AM	5,753.3	5,582.0	18.1	18.3	NR	NR	NA	31	23	24	17	8	7	14	NR	NR	NA	#VALUE!	833	790	762.0	11.0	7.0	4.3	3.3	3.3
	Wed	09/05/07	7:25 AM	5,772.4	5,601.3	19.1	19.3	NR	NR	NA	24	20	14	13	4	10	11	NR	NR	NA	#VALUE!	834	791	774.3	12.3	4.7	13.1	1.9	2.0
	Thu	09/06/07	7:40 AM	5,792.9	5,621.8	20.5	20.5	NR	NR	NA	25	19	14	12	6	11	13	NR	NR	NA	#VALUE!	835	792	782.0	7.7	5.1	16.7	2.9	2.8
	Fri	09/07/07	7:10 AM	5,809.0	5,637.6	16.1	15.8	NR	NR	NA	32	2	17	12	30	NA	20	NR	NR	NA	#VALUE!	836	794	793.8	11.8	0.0	6.2	0.0	3.2
	Sat	09/08/07	8:30 AM	5,827.5	5,656.5	18.5	18.9	NR	NR	NA	31	30	20	12	1	11	19	NR	NR	NA	#VALUE!	838	795	780.0	NA	0.0	11.1	0.0	3.9
	Sun	09/09/07	8:00 AM	5,841.7	5,670.6	14.2	14.1	NR	NR	NA	31	30	18	17	1	13	14	NR	NR	NA	#VALUE!	840	797	821.0	41.0	0.2	4.2	0.0	6.2
58	Mon	09/10/07	7:00 AM	5,856.0	5,684.8	28.5	28.3	NR	NR	NA	26	16	16	14	10	10	12	NR	NR	NA	#VALUE!	841	799	831.4	10.4	9.1	6.2	5.4	5.4
	Tue	09/11/07	7:00 AM	NR	NR	NA	NA	NR	NR	NA	28	15	18	14	13	10	14	NR	NR	NA	#VALUE!	842	801	842.0	10.6	18.8	6.6	3.9	0.0
	Wed	09/12/07	6:55 AM	5,885.8	5,714.6	29.8	29.8	NR	NR	NA	41	43	39	0	-2	2	41	NR	NR	NA	#VALUE!	844	802	853.2	11.2	0.6	6.6	0.2	6.7
	Thu	09/13/07	7:05 AM	5,896.7	5,724.9	10.9	10.3	NR	NR	NA	33	26	19	16	7	14	17	345	1,746.6	158,700	250	845	803	860.3	7.1	3.4	9.2	6.5	11.5
	Fri	09/14/07	7:00 AM	5,907.1	5,735.2	10.4	10.3	NR	NR	NA	21	20	16	15	1	5	6	250	1,961.8	215,200	347	846	804	867.7	7.4	3.7	9.7	6.3	10.8
	Sat	09/15/07	8:30 AM	5,919.7	5,747.2	12.6	12.0	NR	NR	NA	20	23	28	17	-3	-8	3	386	2,216.9	255,100	346	847	806	886.7	19.0	5.0	0.0	5.4	0.0
	Sun	09/16/07	8:30 AM	5,930.3	5,758.5	10.6	11.3	NR	NR	NA	30	24	27	18	6	3	12	388	2,449.7	232,800	355	848	807	904.8	18.1	5.3	0.9	8.3	0.8
59	Mon	09/17/07	7:05 AM	5,943.5	5,771.4	13.2	12.9	NR	NR	NA	30	20	25	16	10	5	14	335	2,714.6	264,900	338	849	808	917.3	12.5	9.0	4.1	8.2	6.1
	Tue	09/18/07	7:20 AM	5,955.6	5,784.3	12.1	12.9	NR	NR	NA	31	30	20	17	1	11	14	363	2,974.6	260,000	347	851	809	944.1	26.8	0.5	7.2	0.0	6.5
	Wed	09/19/07	7:35 AM	5,968.5	5,797.1	12.9	12.8	NR	NR	NA	33	27	19	17	6	14	16	348	3,240.0	265,400	344	852	810	962.1	18.0	3.1	9.3	4.1	5.4
	Thu	09/20/07	8:06 AM	5,981.3	5,808.9	12.8	11.8	NR	NR	NA	32	22	29	16	10	3	16	364	228.5	NA	#VALUE!	853	812	988.5	26.4	6.0	0.7	5.8	0.0
	Fri	09/21/07	9:00 AM	5,996.8	5,824.6	15.5	15.7	NR	NR	NA	30	13	10	17	17	20	13	387	497.2	268,700	287	854	813	1006.5	18.0	6.4	4.4	4.3	4.3
	Sat	09/22/07	8:00 AM	6,008.6	5,836.3	11.8	11.7	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	743.6	246,400	350	856	815	1024.5	18.0	7.5	5.7	5.8	5.8
	Sun	09/23/07	7:40 AM	6,029.2	5,855.4	20.6	19.1	NR	NR	NA	32	20	29	16	12	3	16	356	1,172.6	429,000	361	857	817	1069.0	44.5	7.8	0.4	3.3	0.0
60	Mon	09/24/07	7:00 AM	6,033.6	5,861.3	4.4	5.9	NR	NR	NA	31	26	21	16	5	10	15	373	1,284.7	112,100	371	858	817	1078.2	9.2	3.3	5.7	5.7	5.7
	Tue	09/25/07	7:19 AM	6,036.5	5,876.5	2.9	15.2	NR	NR	NA	38	4	31	15	NA	7	23	276	1,530.0	245,300	839	858	821	1091.0	12.8	6.2	1.0	6.6	0.0
	Wed	09/26/07	7:00 AM	6,036.5	5,892.6	0.0	16.1	NR	NR	NA	38	4	32	15	NA	6	23	277	1,778.4	248,400	#DIV/0!	858	826	1107.1	16.1	6.2	0.7	6.6	0.0
	Thu	09/27/07	7:00 AM	6,036.5	5,905.0	0.0	12.4	NR	NR	NA	36	6	23	20	NA	13	16	136	1,913.6	135,200	#DIV/0!	858	828	1113.8	6.7	6.2	5.2	6.6	6.2
	Fri	09/28/07	7:00 AM	6,036.5	5,921.3	0.0	16.3	NR	NR	NA	39	6	28	15	NA	11	24	273	2,166.4	252,800	#DIV/0!	858	833	1130.5	16.7	6.2	1.8	6.6	0.0
	Sat	09/29/07	8:30 AM	6,036.5	5,935.2	0.0	13.9	NR	NR	NA	34	6	29	16	NA	5	18	245	2,342.2	175,800	#DIV/0!	858	836	1140.5	10.0	6.2	1.6	6.6	0.9
	Sun	09/30/07	8:00 AM	6,036.5	5,950.0	0.0	14.8	NR	NR	NA	38	6	24	17	NA	14	21	200	2,520.8	178,600	#DIV/0!	858	837	1143.9	3.4	6.2	9.7	6.6	6.1
61	Mon	10/01/07	7:50 AM	6,036.5	5,965.7	0.0	15.7	NR	NR	NA	38	7	30	17	NA	8	21	281	2,715.1	194,300	#DIV/0!	858	840	1156.1	12.2	6.2	2.5	6.6	3.6
	Tue	10/02/07	7:27 AM	6,036.5	5,980.4	0.0	14.7	NR	NR	NA	39	6	31	18	NA	8	21	262	2,915.4	200,300	#DIV/0!	858	843	1165.9	9.8	6.2	0.8	6.6	0.0
	Wed	10/03/07	8:52 AM	6,036.5	5,995.1	0.0	14.7	NR	NR	NA	35	6	27	19	NA	8	16	248	3,114.3	198,900	#DIV/0!	858	845	1173.2	7.3	6.2	3.6	6.6	1.2
	Thu	10/04/07	7:35 AM	6,036.5	6,008.8	0.0	13.7	NR	NR	NA	36	6	30	18	NA	6	18	248	29.5	NA	#VALUE!	858	848	1183.9	10.7	6.2	1.6	6.6	0.0
	Fri	10/05/07	7:15 AM	6,036.5	6,022.6	0.0	13.8	NR	NR	NA	36	6	31	19	NA	5	17	274	218.2	188,700	#DIV/0!	858	851	1194.0	10.1	6.2	0.7	6.6	0.0
	Sat	10/06/07	8:30 AM	6,047.5	6,035.4	11.0	12.8	NR	NR	NA	32	6	28	19	NA	4	13	468	356.0	137,800	194	859	852	1201.0	7.0	1.3	6.1	0.9	8.0
	Sun	10/07/07	9:00 AM	6,066.8	6,054.2	19.3	18.8	NR	NR	NA	30	17	15	15	13	15	15	201	733.0	377,000	330	859	853	1204.3	3.3	2.0	0.0	5.7	0.0
62	Mon	10/08/07	NR	6,067.0	6,073.7	0.2	19.5	NR	NR	NA	26	16	19	15	10	7	11	223	988.8	255,800	10,768	860	855	1224.8	20.5	16.7	5.9	0.3	0.7
	Tue	10/09/07	NR	6,097.8	6,084.2	30.8	10.5	NR	NR	NA	36	30	50	16	6	NA	20	281	1,234.1	245,300	261	862	856	1236.9	12.1	2.1	0.0	3.8	0.0
	Wed	10/10/07	NR	6,112.4	6,098.5	14.6	14.3	NR	NR	NA	31	27	22	16	4	9	15	378	1,489.9	255,800	295	863	858	1246.0	9.1	3.6	6.5	5.4	5.3
	Thu	10/11/07	NR	6,124.9	6,110.5	12.5	12.0	NR	NR	NA	29	23	27	17	6	2	12	404	1,733.3	243,400	331	864	860	1256.6	10.6	4.9	0.1	5.2	0.0
	Fri	10/12/07	NR	6,137.1	6,122.6	12.2	12.1	NR	NR	NA	31	21	23	16	10	8	15	363	1,977.0	243,700	334	865	861	1263.1	6.5	7.0	4.0	4.2	4.2
	Sat	10/13/07	NR	6,150.7	6,135.6	13.6	13.0	NR	NR	NA	42	37	39	30	5	3	12	165	2,254.1	277,100	347	866	863	1273.4	10.3	8.3	2.0	8.1	0.0
	Sun	10/14/07	NR	6,160.9	6,146.8	10.2	11.2	NR	NR	NA	41	57	23	13	NA	18	28	233	2,490.4	236,300	369	868	864	1283.9	10.5	0.0	4.9	0.0	8.5
63	Mon	10/15/07	NR	6,175.4	6,160.9	14.5	14.1	NR	NR	NA	30	22	26	16	8	4	14	387	2,757.3	266,900	311	869	866	1294.0	10.1	4.4	0.5	5.0	0.0
	Tue	10/16/07	7:05 AM	6,191.4	6,161.0	16.0	0.1	NR	NR	NA	40	27	1	15	13	NA	25	253	3,010.7	253,400	21,249	871	866	1307.7	13.7	7.8	0.6	3.2	0.3
	Wed	10/17/07	7:20 AM	6,205.2	6,161.0	13.8	0.0	NR	NR	NA	36	33	1	16	3	NA	20	295	3,222.5	211,800	#DIV/0!	874	866	1320.8	13.1	0.7	0.6	0.0	0.3
	Thu	10/18/07	7:20 AM	6,218.6	6,161.0	13.4	0.0	NR	NR	NA	37	30	1	16	7	NA	21	265	161.8	NA	#VALUE!	876	866	1328.2	7.4	2.2	0.6	2.9	0.3
	Fri	10/19/07	7:15 AM	26.4	6,161.0	NA	0.0	NR	NR	NA	37	29	4	16	8	NA	21	260	349.8	188,000	#VALUE!	879	866	1338.4	10.2	2.7	0.6	4.8	0.3
	Sat	10/20/07	8:00 AM	38.2	6,161.0	11.8	0.0	NR	NR	NA	38	29	4	16	9	NA	22	260	530.3	180,500	#DIV/0!	881	866	1345.3	6.9	3.5	0.6	6.1	0.3
	Sun	10/21/07	7:45 AM	51.6	6,161.0	13.4	0.0	NR	NR	NA	37	31	4	16	6	NA	21	272	725.2	194,900	#DIV/0!	884	866	1356.2	10.9	0.7	0.6	0.6	0.3
64	Mon	10/22/07	7:00 AM	66.9	6,161.0	15.3	0.0	NR	NR	NA	45	58	5	11	-13	NA	34	NR	947.3	222,100	#DIV/0!	886	866	1365.2	9.0	0.0	0.6	0.0	0.3
	Tue	10/23/07	7:00 AM	84.3	6,161.0	17.4	0.0	NR	NR	NA	36	32	4	15	4	NA	21	275	1,191.8	244,500	#DIV/0!	890	866	1377.3	12.1	0.4	0.6	0.0	0.3
	Wed	10/24/07	7:45 AM	100.7	6,161.0	16.4	0.0	NR	NR	NA	38	26	29	16	12	NA	22	237	1,384.6	192,800	#DIV/0!	892	866	1389.3	12.0	4.5	0.6	5.9	0.3
	Thu	10/25/07	NR	114.3	6,161.0	13.6	0.0	NR	NR	NA	37	30	36	15	7	NA	22	264	1,591.6	207,000	#DIV/0!	895	866	1394.9	5.6	1.9	0.6	2.0	0.3
	Fri	10/26/07	7:00 AM	127.8	6,161.0	13.5	0.0	NR	NR	NA	46	52	35	12	-6	NA	34	365	1,782.0	190,400	#DIV/0!	897	866	1404.4	9.5	0.0	0.6	0.0	0.3
	Sat	10/27/07	8:30 AM	141.5	6,161.0	13.7	0.0	NR	NR	NA	36	28	23	16	8	NA	20	254	1,964.0	182,000	#DIV/0!	900	866	1412.0	7.6	1.9	0.6	2.4	0.3
	Sun	10/28/07	9:30 AM	156.6	6,161.0	15.1	0.0	NR	NR	NA	37	27	22	16	10	NA	21	253	2,181.2	217,200	#DIV/0!	903	866	1422.5	10.5	2.2	0.6	0.8	0.3

Table A-1. US EPA Arsenic Demonstration Project at Arnaudville, LA - Daily System Operation Log Sheet (Continued)

Week No.	Day of Week	Date	Time	Tank A Hour Meter hrs	Tank B Hour Meter hrs	TA Run Time hrs	TB Run Time hrs	$KMnO_4$ Tank 1 Level[(a)] inches	$KMnO_4$ Tank 2 Level (Iron) inches	Estimated $KMnO_4$ Dosage µg/L as Mn	Pressure Filtration: Influent psig	Outlet Tank A psig	Outlet Tank B psig	Effluent psig	Inlet-TA psig	Inlet-TB psig	Inlet-Effluent psig	Flow rate gpm	Totalizer to Distribution kgal	Gallon Usage gal	Daily Average Flowrate gpm	Backwash: Tank A No.	Tank B No.	Total Volume kgal	Daily Volume kgal	Since Last BW: Run Time Tank A hrs	Run Time Tank B hrs	Standby Time Tank A hrs	Standby Time Tank B hrs
	Mon	10/29/07	7:00 AM	170.6	6,161.0	14.0	0.0	NR	NR	NA	36	29	22	17	7	NA	19	273	2,376.9	195,700	#DIV/0!	906	866	1432.5	10.0	1.6	0.6	0.0	0.3
	Tue	10/30/07	7:30 AM	186.1	6,161.0	15.5	0.0	NR	NR	NA	36	31	29	16	5	NA	20	275	2,565.6	188,700	#DIV/0!	909	866	NR	NA	0.3	0.6	0.0	0.3
	Wed	10/31/07	7:00 AM	200.5	6,161.0	14.4	0.0	NR	NR	NA	39	25	35	16	14	NA	23	217	2,777.5	211,900	#DIV/0!	911	866	1449.8	17.3	5.4	0.6	4.0	0.3
65	Thu	11/01/07	7:00 AM	214.4	6,161.0	13.9	0.0	NR	NR	NA	37	27	35	16	10	NA	21	240	2,977.3	199,800	#DIV/0!	914	866	1460.5	10.7	3.9	0.6	4.9	0.3
	Fri	11/02/07	7:00 AM	233.1	6,161.0	18.7	0.0	NR	NR	NA	37	27	5	16	10	NA	21	246	3,187.1	209,800	#DIV/0!	917	866	1471.3	10.8	2.5	0.6	3.2	0.3
	Sat	11/03/07	8:25 AM	247.7	6,161.0	14.6	0.0	NR	NR	NA	36	30	7	17	6	NA	19	260	117.8	-3,069,300	#DIV/0!	920	866	1481.8	10.5	1.3	0.6	0.5	0.3
	Sun	11/04/07	10:30 AM	264.9	6,161.0	17.2	0.0	NR	NR	NA	36	23	4	16	13	NA	20	280	361.3	243,500	#DIV/0!	923	866	1492.7	10.9	3.2	0.6	0.0	0.3
	Mon	11/05/07	7:00 AM	278.0	6,161.0	13.1	0.0	NR	NR	NA	36	28	4	17	8	NA	19	251	552.0	190,700	#DIV/0!	926	866	1503.0	10.3	1.5	0.6	0.0	0.3
	Tue	11/06/07	7:00 AM	293.7	6,175.6	15.7	14.6	NR	NR	NA	29	21	24	16	8	5	13	378	833.1	281,100	310	927	867	1512.1	9.1	8.7	4.3	5.5	5.6
	Wed	11/07/07	7:00 AM	308.8	6,191.4	15.1	15.8	NR	NR	NA	33	20	19	15	13	14	18	340	1,121.3	288,200	311	929	868	1524.7	12.6	6.0	8.7	6.1	7.0
66	Thu	11/08/07	7:00 AM	321.9	6,204.5	13.1	13.1	NR	NR	NA	30	22	26	16	8	4	14	403	1,374.7	253,400	322	931	870	1538.3	13.6	3.4	0.3	5.1	0.0
	Fri	11/09/07	7:00 AM	332.6	6,216.5	10.7	12.0	NR	NR	NA	32	22	26	17	10	6	15	401	1,552.1	177,400	261	933	872	1541.3	3.0	4.0	1.4	6.6	2.3
	Sat	11/10/07	7:30 AM	344.7	6,228.9	12.1	12.4	NR	NR	NA	40	27	0	15	13	40	25	270	1,923.1	371,000	505	935	873	1562.7	21.4	2.5	0.0	4.3	0.0
	Sun	11/11/07	7:30 AM	356.3	6,240.2	11.6	11.3	NR	NR	NA	31	26	22	16	5	9	15	393	2,187.2	264,100	384	937	875	1576.5	13.8	0.6	4.6	1.8	8.2
	Mon	11/12/07	7:20 AM	368.9	6,252.3	12.6	12.1	NR	NR	NA	32	28	20	15	4	12	17	400	2,467.1	279,900	378	939	877	1590.5	14.0	0.4	4.3	0.0	6.4
	Tue	11/13/07	7:00 AM	379.1	6,261.8	10.2	9.5	NR	NR	NA	34	19	27	15	15	7	19	386	2,696.9	229,800	389	940	879	1600.1	9.6	5.0	0.8	6.0	0.0
	Wed	11/14/07	6:55 AM	388.3	6,271.6	9.2	9.8	NR	NR	NA	33	24	20	15	9	13	18	377	2,929.4	232,500	408	942	880	1610.4	10.3	3.2	5.1	6.7	7.3
67	Thu	11/15/07	7:00 AM	400.3	6,283.6	12.0	12.0	NR	NR	NA	33	28	19	16	5	14	17	396	3,204.7	275,300	382	944	882	1623.9	13.5	0.7	5.5	0.6	6.5
	Fri	11/16/07	NR	NR	NR	NA	NA	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	NR	NA	#VALUE!	NR	NR	NR	NA	NR	NR	NR	NR
	Sat	11/17/07	8:30 AM	422.1	6,304.4	21.8	20.8	NR	NR	NA	41	1	25	14	40	16	27	268	441.6	NA	#VALUE!	947	885	1644.9	21.0	0.0	4.2	0.0	7.3
	Sun	11/18/07	8:00 AM	431.9	6,314.4	9.8	10.0	NR	NR	NA	33	21	24	16	12	9	17	390	668.1	226,500	381	949	887	1658.4	13.5	4.2	1.6	8.1	3.8
	Mon	11/19/07	6:50 AM	442.7	6,325.9	10.8	11.5	NR	NR	NA	32	21	26	16	11	6	16	397	924.4	256,300	383	951	889	1672.0	13.6	3.6	0.8	6.6	0.2
	Tue	11/20/07	7:00 AM	454.3	6,337.5	11.6	11.6	NR	NR	NA	32	21	27	17	11	5	15	400	1,191.9	267,500	384	953	891	1685.7	13.7	4.1	0.1	5.1	0.0
	Wed	11/21/07	6:50 AM	466.0	6,349.5	11.7	12.0	NR	NR	NA	31	23	26	16	8	5	15	410	1,463.0	271,100	381	955	894	1702.9	17.2	4.5	0.9	5.4	1.4
68	Thu	11/22/07	NR	476.5	6,359.9	10.5	10.4	NR	NR	NA	33	24	20	15	9	13	18	377	1,717.3	254,300	406	957	896	1726.1	23.2	3.2	5.1	0.7	7.3
	Fri	11/23/07	8:00 AM	487.3	6,371.6	10.8	11.7	NR	NR	NA	33	27	19	17	6	14	16	404	1,972.4	255,100	379	959	897	1726.8	0.7	0.7	4.8	1.1	8.1
	Sat	11/24/07	7:23 AM	498.3	6,382.6	11.0	11.0	NR	NR	NA	33	28	18	16	5	15	17	388	2,236.6	264,200	400	961	899	1740.2	13.4	0.7	5.2	0.0	7.5
	Sun	11/25/07	8:00 AM	508.4	6,390.9	10.1	8.3	NR	NR	NA	32	21	25	17	11	7	15	386	2,468.5	231,900	424	963	901	1752.8	12.6	3.5	1.0	6.8	0.7
	Mon	11/26/07	9:47 AM	518.3	6,402.5	9.9	11.6	NR	NR	NA	32	22	24	17	10	8	15	394	2,701.1	232,600	363	964	903	1763.6	10.8	4.0	1.6	7.6	5.4
	Tue	11/27/07	7:00 AM	530.2	6,414.4	11.9	11.9	NR	NR	NA	41	1	25	15	40	16	26	247	2,979.5	278,400	390	966	905	1777.7	14.1	0.0	3.6	0.0	6.5
	Wed	11/28/07	7:00 AM	541.0	6,424.9	10.8	10.5	NR	NR	NA	34	22	22	16	12	12	18	367	3,234.7	255,200	399	968	907	1791.5	13.8	5.5	3.1	6.6	6.1
69	Thu	11/29/07	7:00 AM	552.3	6,437.2	11.3	12.3	NR	NR	NA	33	28	18	16	5	15	17	380	231.0	NA	#VALUE!	972	909	1811.9	20.4	0.2	4.7	0.0	6.2
	Fri	11/30/07	7:00 AM	564.4	6,448.6	12.1	11.4	NR	NR	NA	30	24	26	17	6	4	13	418	506.5	275,500	391	974	912	1829.2	17.3	1.0	0.1	0.0	0.0
	Sat	12/01/07	8:00 AM	573.7	6,458.0	9.3	9.4	NR	NR	NA	38	11	10	16	27	28	22	392	722.2	215,700	385	976	913	1839.9	10.7	0.6	4.5	0.6	6.6
	Sun	12/02/07	9:00 AM	584.4	6,469.1	10.7	11.1	NR	NR	NA	30	25	25	17	5	5	13	418	985.0	262,800	402	978	916	1857.4	17.5	1.1	0.6	0.4	0.0
	Mon	12/03/07	6:55 AM	594.7	6,478.9	10.3	9.8	NR	NR	NA	31	27	22	16	4	9	15	401	1,204.5	219,500	364	979	917	1864.8	7.4	0.0	0.0	0.0	0.0
	Tue	12/04/07	7:05 AM	605.3	6,489.6	10.6	10.7	NR	NR	NA	30	25	24	16	5	6	14	404	1,418.0	213,500	334	982	919	1880.8	16.0	1.0	1.1	0.0	0.8
	Wed	12/05/07	7:00 AM	616.5	6,500.6	11.2	11.0	NR	NR	NA	34	19	26	16	15	8	18	382	1,693.9	275,900	414	983	921	1891.4	10.6	6.5	1.4	5.8	1.2
70	Thu	12/06/07	7:00 AM	626.5	6,511.2	10.0	10.6	NR	NR	NA	33	21	25	16	12	8	17	393	1,942.3	248,400	402	985	923	1904.6	13.2	4.5	1.1	6.3	0.8
	Fri	12/07/07	7:00 AM	637.3	6,522.6	10.8	11.4	NR	NR	NA	32	22	25	16	10	7	16	408	2,195.1	252,800	380	987	925	1918.6	14.0	3.8	0.7	6.6	0.7
	Sat	12/08/07	8:30 AM	648.0	6,533.8	10.7	11.2	NR	NR	NA	32	22	25	16	10	7	16	402	2,444.0	248,900	379	989	927	1932.7	14.1	3.2	1.0	6.5	0.7
	Sun	12/09/07	9:00 AM	659.7	6,544.4	11.7	10.6	NR	NR	NA	40	28	4	15	12	36	25	267	2,695.6	251,600	377	991	928	1942.8	10.1	2.6	0.0	4.5	0.0
	Mon	12/10/07	7:20 AM	675.1	6,544.1	15.4	-0.3	NR	NR	NA	31	27	21	16	4	10	15	381	2,954.7	259,100	-7,057	996	928	1960.7	17.9	1.0	0.0	0.0	0.0
	Tue	12/11/07	7:00 AM	687.7	6,546.8	12.6	2.7	NR	NR	NA	38	34	3	17	4	35	21	302	3,181.1	226,400	849	1000	928	1975.3	14.6	0.3	0.0	0.0	0.0
	Wed	12/12/07	7:01 AM	702.5	6,546.8	14.8	0.0	NR	NR	NA	39	31	3	15	8	36	24	285	142.3	NA	#VALUE!	1004	928	1989.7	14.4	1.1	0.0	0.0	0.0
71	Thu	12/13/07	7:00 AM	716.3	6,546.8	13.8	0.0	NR	NR	NA	38	34	3	16	4	35	22	290	362.0	219,700	#DIV/0!	1009	928	2007.5	17.8	0.3	0.0	0.0	0.0
	Fri	12/14/07	7:15 AM	731.4	6,546.8	15.1	0.0	NR	NR	NA	38	34	0	17	4	38	21	310	602.4	240,400	#DIV/0!	1014	928	2024.9	17.4	0.1	0.0	0.0	0.0
	Sat	12/15/07	7:00 AM	741.2	6,554.4	9.8	7.6	NR	NR	NA	33	26	21	17	7	12	16	370	822.1	219,700	428	1015	928	2028.5	3.6	3.2	7.7	7.0	10.9
	Sun	12/16/07	8:30 AM	758.4	6,555.9	17.2	1.5	NR	NR	NA	39	32	3	16	7	36	23	300	1,109.0	286,900	1,733	1019	928	2042.2	13.7	0.8	0.0	0.0	0.0
	Mon	12/17/07	7:00 AM	774.6	6,555.9	16.2	0.0	NR	NR	NA	46	4	3	12	42	43	34	0	1,373.3	264,300	#DIV/0!	1022	928	2052.8	10.6	0.0	0.0	0.0	0.0
	Tue	12/18/07	7:00 AM	787.2	6,567.2	12.6	11.3	NR	NR	NA	35	23	21	16	12	14	19	369	1,644.8	271,500	380	1024	928	2060.1	7.3	6.2	7.4	6.5	7.6
	Wed	12/19/07	7:05 AM	798.3	6,577.3	11.1	10.1	NR	NR	NA	33	24	21	16	9	12	17	383	1,908.8	264,000	416	1026	928	2070.3	10.2	3.0	6.6	5.5	7.9
72	Thu	12/20/07	7:00 AM	808.8	6,587.6	10.5	10.3	NR	NR	NA	34	24	21	17	10	13	17	380	2,146.6	237,800	381	1027	929	2077.4	7.1	4.2	8.7	7.2	10.7
	Fri	12/21/07	7:00 AM	820.0	6,598.8	11.2	11.2	NR	NR	NA	6	19	10	12	-13	-4	-6	0	2,399.9	253,300	377	1028	931	2087.9	10.5	7.2	1.1	7.2	0.2
	Sat	12/22/07	8:30 AM	830.2	6,608.6	10.2	9.8	NR	NR	NA	33	21	26	17	12	7	16	380	2,633.4	233,500	389	1029	932	2094.6	6.7	8.2	2.7	10.3	3.9
	Sun	12/23/07	8:13 AM	842.9	6,621.7	12.7	13.1	NR	NR	NA	32	26	21	17	6	11	15	395	2,927.7	294,300	380	1031	933	2105.0	10.4	2.4	6.4	0.0	7.5
	Mon	12/24/07	12:30 PM	855.3	6,634.3	12.4	12.6	NR	NR	NA	43	39	37	NR	4	6	NA	191	3,217.2	289,500	386	1032	934	2112.0	7.0	4.8	9.5	3.2	8.4
	Tue	12/25/07	10:30 AM	866.5	6,644.6	11.2	10.3	NR	NR	NA	32	21	28	NR	11	4	NA	413	398.0	NA	#VALUE!	1033	936	2122.5	10.5	6.6	0.3	8.1	0.0
	Wed	12/26/07	7:00 AM	876.5	6,655.0	10.0	10.4	NR	NR	NA	32	22	27	17	10	5	15	413	400.0	2,000	3	1034	937	2129.7	7.2	7.9	0.7	8.3	1.3
73	Thu	12/27/07	7:05 AM	888.6	6,667.2	12.1	12.2	NR	NR	NA	40	1	29	15	39	11	25	288	686.1	286,100	392	1035	938	2136.7	7.0	0.0	3.4	0.8	6.0
	Fri	12/28/07	7:00 AM	899.3	6,678.4	10.7	11.2	NR	NR	NA	6	11	10	14	-5	-4	-8	11	257.0	-429,100	-653	1037	939	8.2	NA	1.6	6.2	0.3	6.3
	Sat	12/29/07	8:30 AM	910.0	6,689.4	10.7	11.0	NR	NR	NA	8	11	10	11	-3	-2	-3	11	529.4	272,400	419	1039	941	25.0	16.8	1.8	0.8	1.9	0.2
	Sun	12/30/07	8:30 AM	920.9	6,700.8	10.9	11.4	NR	NR	NA	31	23	25	17	8	6	14	423	783.7	254,300	380	1041	942	32.1	7.1	4.1	2.1	8.4	6.2
	Mon	12/31/07	7:00 AM	931.8	6,712.0	10.9	11.2	NR	NR	NA	5	11	10	14	-6	-5	-9	0	1,033.8	250,100	377	1041	943	35.6	3.5	7.9	3.8	8.4	7.6
	Tue	01/01/08	1:00 PM	947.4	6,727.0	15.6	15.0	NR	NR	NA	5	11	10	13	-6	-5	-8	0	1,388.2	354,400	386	1043	945	53.0	17.4	5.5	1.5	7.4	1.1
	Wed	01/02/08	7:00 AM	956.0	6,736.0	8.6	9.0	NR	NR	NA	8	11	10	11	-3	-2	-3	0	1,585.1	196,900	373	1044	946	60.1	7.1	6.1	1.3	5.5	1.5
74	Thu	01/03/08	7:00 AM	969.0	6,749.0	13.0	13.0	NR	NR	NA	33	27	20	17	6	13	16	384	1,889.5	304,400	390	1046	947	70.9	10.8	1.8	7.1	0.0	3.4
	Fri	01/04/08	7:00 AM	983.0	6,764.0	14.0	15.0	NR	NR	NA	33	21	25	17	12	8	16	374	2,219.1	329,600	379	1047	949	81.7	10.8	7.3	3.6	4.5	1.8
	Sat	01/05/08	10:00 AM	998.1	6,778.7	15.1	14.7	NR	NR	NA	33	21	25	15	12	8	18	398	2,562.0	342,900	384	1049	951	96.0	14.3	6.4	3.0	5.4	2.1
	Sun	01/06/08	1:00 PM	1,012.7	6,794.0	14.6	15.3	NR	NR	NA	33	26	21	16	7	12	17	392	2,915.5	353,500	394	1052	953	113.8	17.8	2.0	6.3	1.1	2.8
	Mon	01/07/08	7:00 AM	1,020.5	6,801.9	7.8	7.9	NR	NR	NA	43	42	39	10	1	4	33	196	3,112.0	196,500	417	1054	955	128.1	14.3	1.0	2.7	0.0	4.3
	Tue	01/08/08	7:00 AM	1,032.2	6,812.6	11.7	10.7	NR	NR	NA	32	22	24	17	10	8	15	400	109.4	NA	#VALUE!	1056	958	146.4	18.3	2.8	1.8	4.8	2.6
	Wed	01/09/08	7:00 AM	1,042.9	6,823.1	10.7	10.5	NR	NR	NA	5	11	9	0	-6	-4	5	0	317.4	208,000	327	1059	961	168.0	21.6	1.8	0.3	2.3	0.6
75	Thu	01/10/08	7:00 AM	1,053.2	6,834.2	10.3	11.1	NR	NR	NA	29	25	25	17	4	4	12	436	636.3	318,900	497	1062	964	189.3	21.3	0.9	0.0	0.6	0.1
	Fri	01/11/08	7:00 AM	1,064.2	6,844.8	11.0	10.6	NR	NR	NA	5	11	10	11	-6	-5	-6	0	894.2	257,900	398	1064	967	206.9	17.6	2.3	0.8	0.8	0.7
	Sat	01/12/08	9:00 AM	1,075.5	6,856.1	11.3	11.3	NR	NR	NA	31	22	25	17	9	6	14	425	1,181.6	287,400	424	1067	971	230.7	23.8	3.6	0.9	3.0	0.6
	Sun	01/13/08	9:00 AM	1,085.2	6,865.9	9.7	9.8	NR	NR	NA	30	24	25	18	6	5	12	430	1,443.4	261,800	448	1070	975	255.2	24.5	1.3	0.6	0.0	0.0

Table A-1. US EPA Arsenic Demonstration Project at Arnaudville, LA - Daily System Operation Log Sheet (Continued)

Week No.	Day of Week	Date	Time	Tank A Hour Meter hrs	Tank B Hour Meter hrs	TA Run Time hrs	TB Run Time hrs	$KMnO_4$ Tank 1 Level[(a)] inches	$KMnO_4$ Tank 2 Level (Iron) inches	Estimated $KMnO_4$ Dosage µg/L as Mn	Pressure Filtration: Influent psig	Outlet Tank A psig	Outlet Tank B psig	Effluent psig	Inlet-TA psig	Inlet-TB psig	Inlet-Effluent psig	Flow rate gpm	Totalizer to Distribution kgal	Gallon Usage gal	Daily Average Flowrate gpm	Backwash: Tank A No.	Tank B No.	Total Volume kgal	Daily Volume kgal	Since Last BW: Run Time Tank A hrs	Run Time Tank B hrs	Standby Time Tank A hrs	Standby Time Tank B hrs
76	Mon	01/14/08	7:00 AM	1,096.3	6,877.1	11.1	11.2	NR	NR	NA	31	23	25	12	8	6	19	417	1,720.6	277,200	414	1073	978	276.0	20.8	1.7	1.0	0.8	0.8
	Tue	01/15/08	7:00 AM	1,106.9	6,887.5	10.6	10.4	NR	NR	NA	32	23	23	17	9	9	15	393	1,984.6	264,000	419	1076	981	296.8	20.8	1.9	1.7	3.5	3.1
	Wed	01/16/08	7:00 AM	1,117.4	6,898.1	10.5	10.6	NR	NR	NA	30	25	23	17	5	7	13	414	2,252.2	267,600	423	1080	985	325.2	28.4	1.0	0.0	1.5	5.4
	Thu	01/17/08	7:00 AM	1,127.7	6,908.9	10.3	10.8	NR	NR	NA	5	1	10	11	4	-5	-6	0	2,504.4	252,200	399	1082	988	342.4	17.2	0.0	1.5	0.0	2.3
	Fri	01/18/08	7:00 AM	1,139.3	6,919.8	11.6	10.9	NR	NR	NA	30	24	22	16	6	8	14	394	2,787.6	283,200	420	1087	993	377.3	34.9	3.4	2.7	4.7	4.7
	Sat	01/19/08	11:00 AM	1,151.8	6,931.2	12.5	11.4	NR	NR	NA	43	39	38	30	4	5	13	188	3,077.9	290,300	406	1089	997	398.1	20.8	3.8	2.3	2.5	0.6
	Sun	01/20/08	12:30 PM	1,164.0	6,943.1	12.2	11.9	NR	NR	NA	19	15	15	18	4	4	1	260	105.6	NA	#VALUE!	1092	1003	429.4	31.3	2.8	1.3	0.7	0.0
77	Mon	01/21/08	7:00 AM	1,174.7	6,951.6	10.7	8.5	NR	NR	NA	31	24	22	17	7	9	14	406	323.1	217,500	383	1094	1007	450.2	20.8	2.4	1.1	4.9	2.6
	Tue	01/22/08	7:00 AM	1,192.0	6,966.8	17.3	15.2	NR	NR	NA	7	11	10	11	-4	-3	-4	710	NR	NA	#VALUE!	1096	1014	481.1	30.9	5.9	0.9	3.6	0.2
	Wed	01/23/08	7:00 AM	1,201.9	6,975.5	9.9	8.7	NR	NR	NA	32	28	29	22	4	3	10	406	975.0	NA	#VALUE!	1099	1021	516.0	34.9	0.8	0.2	0.0	0.0
	Thu	01/24/08	7:00 AM	1,215.0	6,983.8	13.1	8.3	NR	NR	NA	40	1	29	15	39	11	25	304	1,277.5	302,500	496	1101	1031	557.3	41.3	0.0	0.3	0.0	0.0
	Fri	01/25/08	7:00 AM	1,230.3	6,999.6	15.3	15.8	NR	NR	NA	42	50	24	14	-8	18	28	180	1,660.7	383,200	411	1105	1040	606.2	48.9	0.0	1.4	0.0	0.0
	Sat	01/26/08	8:00 AM	1,243.6	7,009.3	13.3	9.7	NR	NR	NA	29	24	25	17	5	4	12	440	1,980.3	319,600	475	1108	1046	633.3	27.1	1.1	0.3	0.0	0.0
	Sun	01/27/08	8:30 AM	1,258.4	7,022.9	14.8	13.6	NR	NR	NA	8	11	10	12	-3	-2	-4	300	2,300.5	320,200	376	1110	1050	633.8	0.5	3.4	2.1	4.9	3.0
78	Mon	01/28/08	7:05 AM	1,273.6	7,037.2	15.2	14.3	NR	NR	NA	29	22	23	17	7	6	12	391	2,618.2	317,700	359	1112	1054	674.6	40.8	3.4	1.5	4.3	0.9
	Tue	01/29/08	7:10 AM	1,285.6	7,048.1	12.0	10.9	NR	NR	NA	39	27	3	14	12	36	25	299	2,899.9	281,700	411	1114	1058	695.4	20.8	2.6	0.0	4.6	0.0
	Wed	01/30/08	7:00 AM	1,304.3	7,065.4	18.7	17.3	NR	NR	NA	32	11	20	12	21	12	20	NR	3,283.8	383,900	356	1115	1060	NR	NA	0.0	5.2	0.0	1.5
	Thu	01/31/08	7:30 AM	1,324.9	7,086.1	20.6	20.7	NR	NR	NA	23	19	14	15	4	9	8	296	237.6	NA	#VALUE!	1117	1063	723.1	NA	3.9	12.1	1.7	2.0
	Fri	02/01/08	8:00 AM	1,344.4	7,104.9	19.5	18.8	NR	NR	NA	21	14	19	14	7	2	7	273	522.7	285,100	248	1118	1065	733.5	10.4	8.5	0.6	2.8	0.0
	Sat	02/02/08	6:00 AM	1,362.2	7,122.8	17.8	17.9	NR	NR	NA	21	17	15	15	4	6	6	262	783.3	260,600	243	1120	1066	744.2	10.7	3.1	7.1	2.7	2.7
	Sun	02/03/08	12:00 PM	1,386.5	7,147.3	24.3	24.5	NR	NR	NA	23	19	14	13	4	9	10	255	1,143.4	360,100	246	1122	1068	758.3	14.1	2.3	10.1	0.0	3.8
79	Mon	02/04/08	7:00 AM	1,401.6	7,162.0	15.1	14.7	NR	NR	NA	38	36	33	NR	2	5	NA	146	1,360.3	216,900	243	1123	1069	765.3	7.0	2.9	11.3	1.8	3.6
	Tue	02/05/08	12:00 PM	1,422.2	7,181.6	20.6	19.6	NR	NR	NA	21	16	16	14	5	5	7	260	1,717.7	357,400	297	1125	1072	782.7	17.4	5.2	3.1	3.2	0.0
	Wed	05/06/08	7:00 AM	1,436.8	7,196.1	14.6	14.5	NR	NR	NA	22	21	14	15	1	8	7	260	1,928.9	211,200	242	1126	1073	789.7	7.0	1.0	8.4	0.0	3.4
	Thu	02/07/08	7:00 AM	1,456.2	7,215.5	19.4	19.4	NR	NR	NA	22	19	15	14	3	7	8	270	2,211.6	282,700	243	1127	1074	797.1	7.4	4.8	13.0	2.8	2.8
	Fri	02/08/08	7:30 AM	1,477.3	7,236.3	21.1	20.8	NR	NR	NA	32	1	19	15	31	13	17	201	2,520.1	308,500	245	1129	1077	814.0	16.9	0.0	3.9	0.0	1.3
	Sat	02/09/08	8:30 AM	1,496.6	7,255.4	19.3	19.1	NR	NR	NA	23	15	20	15	8	3	8	251	2,800.7	280,600	244	1131	1079	828.0	14.0	7.7	1.1	3.1	0.0
	Sun	02/10/08	8:30 AM	1,515.5	7,275.1	18.9	19.7	NR	NR	NA	25	19	14	15	6	11	10	250	3,079.1	278,400	241	1133	1080	838.6	10.6	3.6	10.1	3.3	3.3
80	Mon	02/11/08	7:00 AM	1,535.6	7,294.6	20.1	19.5	NR	NR	NA	22	15	20	15	7	2	7	253	86.9	NA	#VALUE!	1134	1082	848.9	10.3	9.5	0.5	1.8	0.0
	Tue	02/12/08	7:00 AM	1,553.8	7,313.1	18.2	18.5	NR	NR	NA	24	15	19	15	9	5	9	252	351.6	264,700	240	1135	1083	856.3	7.4	10.9	3.1	4.5	3.5
	Wed	05/13/08	7:00 AM	1,572.5	7,332.1	18.7	19.0	NR	NR	NA	23	20	14	15	3	9	8	248	627.0	275,400	244	1137	1084	866.9	10.6	1.3	9.5	0.0	3.6
	Thu	02/14/08	7:00 AM	1,591.6	7,351.5	19.1	19.4	NR	NR	NA	21	16	18	15	5	3	6	256	908.7	281,700	244	1138	1086	877.3	10.4	7.0	2.2	1.5	1.1
	Fri	02/15/08	7:00 AM	1,610.8	7,370.7	19.2	19.2	NR	NR	NA	26	15	17	15	11	9	11	238	1,189.4	280,700	244	1139	1087	884.2	6.9	12.8	7.4	1.7	1.7
	Sat	02/16/08	9:12 AM	1,629.6	7,388.6	18.8	17.9	NR	NR	NA	21	16	18	14	5	3	7	273	1,471.1	281,700	256	1141	1090	901.5	17.3	6.7	0.1	3.5	0.0
	Sun	02/17/08	NR	1,647.4	7,406.3	17.8	17.7	NR	NR	NA	23	19	14	15	4	9	8	250	1,753.4	282,300	265	1143	1092	914.3	12.8	7.7	1.4	3.3	0.0
81	Mon	02/18/08	7:00 AM	1,666.8	7,426.5	19.4	20.2	NR	NR	NA	22	20	15	15	2	7	7	254	2,035.7	282,300	238	1145	1093	925.3	11.0	0.6	8.0	0.0	1.8
	Tue	02/19/08	7:00 AM	1,684.9	7,444.6	18.1	18.1	NR	NR	NA	22	20	15	15	2	7	7	252	2,307.3	271,600	250	1147	1095	939.1	13.8	0.4	6.6	0.0	3.6
	Wed	02/20/08	7:00 AM	1,702.3	7,461.5	17.4	16.9	NR	NR	NA	24	16	17	15	8	7	9	241	2,562.6	255,300	248	1148	1097	949.3	10.2	8.3	5.5	3.5	3.5
	Thu	02/21/08	7:00 AM	1,720.2	7,479.4	17.9	17.9	NR	NR	NA	24	16	18	15	8	6	9	236	2,826.2	263,600	245	1150	1099	963.2	13.9	7.5	3.3	3.7	3.7
	Fri	02/22/08	7:00 AM	1,735.5	7,495.1	15.3	15.7	NR	NR	NA	22	16	18	15	6	4	7	250	3,064.1	237,900	256	1152	1101	976.7	13.5	6.8	1.6	4.3	0.5
	Sat	02/23/08	8:00 AM	1,751.9	7,511.7	16.4	16.6	NR	NR	NA	23	19	15	15	4	8	8	253	22.7	NA	#VALUE!	1154	1102	987.2	10.5	2.3	1.8	8.3	4.2
	Sun	02/24/08	8:00 AM	1,773.1	7,533.0	21.2	21.3	NR	NR	NA	23	20	15	15	3	8	8	250	327.1	304,400	239	1156	1104	1001.1	13.9	2.0	0.0	9.1	1.7
82	Mon	02/25/08	7:30 AM	1,791.6	7,551.6	18.5	18.6	NR	NR	NA	28	25	21	18	3	7	10	371	648.4	321,300	289	1161	1109	1035.3	34.2	0.1	1.5	0.0	0.0
	Tue	02/26/08	7:45 AM	1,804.4	7,564.1	12.8	12.5	10.0	NR	NA	31	24	27	17	7	4	14	409	941.8	293,400	387	1166	1115	1073.3	38.0	0.6	0.0	0.0	0.0
	Wed	02/27/08	7:30 AM	1,816.5	7,576.7	12.1	12.6	9.0	NR	NA	41	4	24	15	37	17	26	242	1,218.2	276,400	373	1169	1116	1094.5	21.2	0.0	2.1	0.0	2.6
	Thu	02/28/08	7:30 AM	1,828.4	7,589.4	11.9	12.7	NR	NR	NA	31	24	26	19	7	5	12	418	1,488.6	270,400	367	1172	1121	1114.5	20.0	1.6	0.8	0.9	0.0
	Fri	02/29/08	8:00 AM	1,839.5	7,601.3	11.1	11.9	NR	NR	NA	35	27	18	15	8	17	20	355	1,736.2	247,600	359	1174	1122	1125.0	10.5	1.5	0.0	0.6	0.0
	Sat	03/01/08	6:00 AM	1,848.6	7,610.3	9.1	9.0	NR	NR	NA	37	28	23	16	9	14	21	380	1,934.2	198,000	365	1175	1124	1135.6	10.6	0.0	2.0	5.5	5.4
	Sun	03/02/08	5:00 AM	1,859.5	7,621.8	10.9	11.5	NR	NR	NA	36	32	18	15	4	18	21	375	2,122.3	188,100	280	1177	1125	1145.1	9.5	1.9	0.6	2.0	0.3
83	Mon	03/03/08	7:00 AM	1,873.6	7,636.0	14.1	14.2	NR	NR	NA	31	22	26	17	9	5	14	386	2,479.2	356,900	420	1178	1127	1154.9	9.8	7.2	1.4	5.8	1.7
	Tue	03/04/08	7:00 AM	1,885.3	7,648.5	11.7	12.5	NR	NR	NA	33	29	19	16	4	14	17	366	2,738.2	259,000	357	1180	1128	1165.4	10.5	0.5	5.3	0.0	6.8
	Wed	03/05/08	7:00 AM	1,896.9	7,659.9	11.6	11.4	NR	NR	NA	33	20	28	16	13	5	17	385	2,980.9	242,700	352	1181	1130	1175.5	10.1	4.7	0.7	6.1	0.0
	Thu	03/06/08	7:00 AM	1,910.4	7,673.1	13.5	13.2	NR	NR	NA	32	22	27	15	10	5	17	401	3,276.3	295,400	369	1183	1132	1188.9	13.4	3.7	0.8	2.4	0.0
	Fri	03/07/08	7:00 AM	1,920.4	7,682.9	10.0	9.8	NR	NR	NA	32	28	20	17	4	12	15	394	207.9	NA	#VALUE!	1185	1133	1199.4	10.5	0.3	0.0	4.4	4.8
	Sat	03/08/08	10:00 AM	1,931.9	7,694.8	11.5	11.9	5.0	NR	NA	38	27	0	15	11	38	23	274	476.2	268,300	382	1187	1135	1213.2	13.8	3.1	0.0	0.0	0.0
	Sun	03/09/08	10:00 AM	1,946.0	7,708.4	14.1	13.6	2.0	NR	NA	31	20	22	16	11	9	15	360	776.6	300,400	362	1190	1139	1237.2	24.0	6.5	4.3	6.0	0.8
84	Mon	03/10/08	7:00 AM	1,954.2	7,717.3	8.2	8.9	2.0	NR	NA	31	23	25	17	8	6	14	400	989.9	213,300	416	1192	1142	1251.3	14.1	2.2	1.6	5.1	2.8
	Tue	03/11/08	7:10 AM	1,966.2	7,728.4	12.0	11.1	NR	NR	NA	6	11	10	10	-5	-4	-4	NR	1,251.2	261,300	378	1195	1143	1268.1	16.8	1.0	2.9	0.2	5.5
	Wed	03/12/08	7:10 AM	1,977.4	7,739.1	11.2	10.7	6.0	NR	NA	34	22	23	17	12	11	17	365	1,508.8	257,600	392	1197	1146	1284.5	16.4	3.2	2.4	5.9	5.9
	Thu	03/13/08	7:10 AM	1,988.3	7,750.3	10.9	11.2	12.5	NR	NA	31	22	27	17	9	4	14	399	1,768.1	259,300	391	1201	1150	1311.6	27.1	1.5	0.1	1.7	0.0
	Fri	03/14/08	7:00 AM	1,999.1	7,761.1	10.8	10.8	6.0	NR	NA	42	52	23	14	-10	19	28	246	2,018.1	250,000	386	1204	1153	1334.4	22.8	0.0	2.7	0.0	4.8
	Sat	03/15/08	9:00 AM	2,010.0	7,772.2	10.9	11.1	11.3	NR	NA	39	31	0	14	8	39	25	305	2,293.7	275,600	418	1210	1158	1368.5	34.1	0.4	0.0	0.0	0.0
	Sun	03/16/08	9:00 AM	2,020.9	7,783.3	10.9	11.1	11.3	NR	NA	32	21	28	17	11	4	15	388	2,567.9	274,200	415	1215	1164	1405.5	37.0	0.7	0.0	0.0	0.0
85	Mon	03/17/08	7:00 AM	2,034.0	7,796.8	13.1	13.5	11.3	NR	NA	41	1	25	13	40	16	28	252	2,883.3	315,400	395	1220	1169	1441.5	36.0	0.0	1.5	0.0	2.2
	Tue	03/18/08	7:30 AM	2,047.0	7,810.0	13.0	13.2	10.0	NR	NA	39	31	0	1	8	39	38	318	3,192.3	309,000	393	1225	1173	1473.4	31.9	0.5	0.0	0.0	0.0
	Wed	03/19/08	8:20 AM	2,059.6	7,822.1	12.6	12.1	8.0	NR	NA	32	21	27	NR	11	5	NA	397	NR	NA	#VALUE!	1227	1176	1489.6	16.2	3.6	0.5	2.6	0.0
	Thu	03/20/08	7:10 AM	2,069.0	7,832.0	9.4	9.9	8.0	NR	NA	43	43	40	NR	0	3	NA	152	412.9	NA	#VALUE!	1229	1177	1499.7	10.1	0.6	4.6	0.0	5.7
	Fri	03/21/08	7:00 AM	2,080.8	7,843.8	11.8	11.8	5.0	NR	NA	41	5	24	15	36	17	26	268	674.5	261,600	369	1230	1179	1510.0	10.3	0.0	3.4	0.0	6.2
	Sat	03/22/08	7:40 AM	2,091.5	7,854.7	10.7	10.9	7.0	NR	NA	36	24	19	16	12	17	20	358	906.7	232,200	358	1232	1180	1520.3	10.3	3.1	7.9	7.3	9.4
	Sun	03/23/08	7:10 AM	2,103.6	7,866.8	12.1	12.1	8.0	NR	NA	35	23	20	15	12	15	20	375	1,186.4	279,700	385	1235	1183	1539.8	19.5	2.3	4.2	1.6	2.1
86	Mon	03/24/08	7:00 AM	2,114.9	7,878.0	11.3	11.2	NR	NR	NA	34	20	25	17	14	9	17	360	1,429.2	242,800	360	1236	1185	1550.0	10.2	4.2	1.4	7.1	3.6
	Tue	03/25/08	7:00 AM	2,128.2	7,890.2	13.3	12.2	8.0	NR	NA	41	26	59	15	15	-18	26	270	1,714.1	284,900	373	1239	1187	1572.1	22.1	2.6	0.0	5.0	0.0
	Wed	03/26/08	7:10 AM	2,139.9	7,902.3	11.7	12.1	10.0	NR	NA	32	28	20	17	4	12	15	377	1,981.1	267,000	374	1242	1190	1589.6	17.5	0.3	3.1	0.0	4.7
	Thu	03/27/08	7:05 AM	2,151.0	7,913.3	11.1	11.0	10.5	NR	NA	41	25	4	15	16	37	26	267	2,229.0	247,900	374	1244	1192	1603.0	13.4	3.3	0.0	5.0	0.0
	Fri	03/28/08	7:00 AM	2,162.3	7,925.3	11.3	12.0	NR	NR	NA	32	24	23	17	8	9	15	380	2,488.8	259,800	372	1247	1195	1623.9	20.9	3.9	4.7	5.1	5.1
	Sat	03/29/08	7:40 AM	2,172.7	7,935.2	10.4	9.9	8.0	NR	NA	31	23	28	17	8	3	14	406	2,736.8	248,000	407	1249	1198	1640.9	17.0	2.1	0.0	5.4	0.0
	Sun	03/30/08	7:30 AM	2,184.0	7,947.1	11.3	11.9	11.0	NR	NA	4	11	8	10	-7	-4	-6	0	2,995.1	258,300	371	1251	1200	1653.1	12.2	3.7	2.2	7.3	6.2

Table A-1. US EPA Arsenic Demonstration Project at Arnaudville, LA - Daily System Operation Log Sheet (Continued)

Week No.	Day of Week	Date	Time	Tank A Hour Meter hrs	Tank B Hour Meter hrs	TA Run Time hrs	TB Run Time hrs	$KMnO_4$ Tank 1 Level[(a)] inches	$KMnO_4$ Tank 2 Level (Iron) inches	Estimated $KMnO_4$ Dosage µg/L as Mn	Pressure Filtration: Influent psig	Pressure Filtration: Outlet Tank A psig	Pressure Filtration: Outlet Tank B psig	Pressure Filtration: Effluent psig	Pressure Filtration: Inlet-TA psig	Pressure Filtration: Inlet-TB psig	Pressure Filtration: Inlet-Effluent psig	Pressure Filtration: Flow rate gpm	Pressure Filtration: Totalizer to Distribution kgal	Pressure Filtration: Gallon Usage gal	Pressure Filtration: Daily Average Flowrate gpm	Backwash: Tank A No.	Backwash: Tank B No.	Backwash: Total Volume kgal	Backwash: Daily Volume kgal	Backwash: Since Last BW: Run Time Tank A hrs	Backwash: Since Last BW: Run Time Tank B hrs	Backwash: Since Last BW: Standby Time Tank A hrs	Backwash: Since Last BW: Standby Time Tank B hrs
87	Mon	03/31/08	7:00 AM	2,196.7	7,959.6	12.7	12.5	11.0	NR	NA	42	25	3	14	17	39	28	256	0.8	NA	#VALUE!	1254	1202	1670.9	17.8	2.3	0.0	5.0	0.0
	Tue	04/01/08	7:00 AM	2,208.1	7,971.2	11.4	11.6	NR	NR	NA	42	51	22	16	-9	20	26	224	264.4	263,600	382	1256	1205	1691.0	20.1	0.0	3.1	0.0	5.9
	Wed	04/02/08	7:00 AM	2,219.5	7,982.5	11.4	11.3	NR	NR	NA	39	30	45	16	9	-6	23	368	521.4	257,000	377	1259	1207	1707.3	16.3	1.4	0.0	1.1	0.0
	Thu	04/03/08	7:00 AM	2,229.9	7,992.8	10.4	10.3	NR	NR	NA	36	21	21	15	15	15	21	340	750.5	229,100	369	1260	1209	1714.0	6.7	6.9	5.4	7.1	6.3
	Fri	04/04/08	7:10 AM	2,240.9	8,004.1	11.0	11.3	NR	NR	NA	36	23	25	16	13	11	20	381	1,000.6	250,100	374	1262	1211	1727.2	13.2	5.1	2.4	4.7	4.7
	Sat	04/05/08	8:30 AM	2,251.1	8,014.4	10.2	10.3	NR	NR	NA	38	33	0	16	5	38	22	315	1,240.4	239,800	390	1264	1212	1737.4	10.2	1.0	0.0	0.0	0.0
	Sun	04/06/08	8:30 AM	2,262.4	8,024.7	11.3	10.3	NR	NR	NA	31	22	28	17	9	3	14	405	1,429.1	188,700	292	1265	1214	1748.1	10.7	4.4	1.2	6.5	0.0
88	Mon	04/07/08	7:00 AM	2,274.3	8,037.3	11.9	12.6	NR	NR	NA	43	44	41	0	-1	2	43	126	1,758.3	329,200	448	1267	1215	1758.5	10.4	0.6	4.6	0.0	5.8
	Tue	04/08/08	7:00 AM	2,286.7	8,049.2	12.4	11.9	NR	NR	NA	34	22	24	16	12	10	18	382	2,030.7	272,400	374	1268	1217	1769.2	10.7	5.2	2.6	6.3	6.3
	Wed	04/09/08	6:55 AM	2,297.9	8,061.6	11.2	12.4	NR	NR	NA	34	22	26	16	12	8	18	378	2,293.1	262,400	372	1270	1219	1782.9	13.7	4.0	1.9	5.5	3.7
	Thu	04/10/08	7:00 AM	2,309.6	8,074.4	11.7	12.8	NR	NR	NA	31	24	27	17	7	4	14	407	2,566.8	273,700	373	1272	1221	1796.9	14.0	3.0	0.8	5.5	0.6
	Fri	04/11/08	6:55 AM	2,321.4	8,086.9	11.8	12.5	NR	NR	NA	32	30	20	17	2	12	15	388	2,834.7	267,900	368	1274	1222	1806.9	10.0	0.0	6.5	0.0	7.2
	Sat	04/12/08	10:15 AM	2,333.1	8,098.3	11.7	11.4	NR	NR	NA	36	33	NR	16	3	NA	20	315	3,139.6	304,900	440	1276	1224	1818.1	11.2	1.0	0.0	0.0	0.0
	Sun	04/13/08	9:15 AM	2,345.6	8,111.1	12.5	12.8	NR	NR	NA	4	11	9	5	-7	-5	-1	0	142.0	NA	#VALUE!	1277	1226	1829.8	11.7	4.7	1.7	7.5	1.3
89	Mon	04/14/08	7:00 AM	2,356.4	8,122.5	10.8	11.4	NR	NR	NA	31	28	22	18	3	9	13	416	346.0	204,000	307	1279	1227	1839.3	9.5	0.0	4.0	0.0	5.3
	Tue	04/15/08	7:00 AM	2,368.0	8,133.6	11.6	11.1	NR	NR	NA	34	20	28	18	14	6	16	384	601.0	255,000	375	1280	1229	1848.9	9.6	6.1	1.2	1.5	0.9
	Wed	04/16/08	7:00 AM	2,380.2	8,146.0	12.2	12.4	NR	NR	NA	41	1	26	15	40	15	26	269	880.3	279,300	378	1282	1231	1862.6	13.7	0.0	2.4	0.0	4.5
	Thu	04/17/08	7:00 AM	2,394.7	8,159.3	14.5	13.3	NR	NR	NA	5	11	10	10	-6	-5	-5	0	1,198.5	318,200	382	1286	1234	1886.5	23.9	1.1	1.9	0.1	0.1
	Fri	04/18/08	7:00 AM	2,407.6	8,171.0	12.9	11.7	NR	NR	NA	32	25	24	17	7	8	15	394	1,488.5	290,000	394	1290	1238	1914.0	27.5	1.0	1.2	0.0	0.5
	Sat	04/19/08	7:00 AM	2,417.7	8,181.0	10.1	10.0	6.0	NR	NA	4	11	9	9	-7	-5	-5	0	1,715.7	227,200	377	1292	1241	1930.6	16.6	1.7	0.6	5.7	1.2
	Sun	04/20/08	7:40 AM	2,429.2	8,193.2	11.5	12.2	11.0	NR	NA	34	25	20	17	9	14	17	375	1,987.0	271,300	382	1295	1243	1947.2	16.6	1.3	3.6	5.5	7.2
90	Mon	04/21/08	7:00 AM	2,444.3	8,207.8	15.1	14.6	15.0	NR	NA	33	21	28	18	12	5	15	395	2,328.9	341,900	384	1298	1247	1970.7	23.5	2.7	0.4	5.3	0.7
	Tue	04/22/08	7:00 AM	2,457.3	8,220.9	13.0	13.1	NR	NR	NA	35	21	23	16	14	12	19	350	2,611.6	282,700	361	1300	1249	1984.6	13.9	5.6	3.5	6.5	6.5
	Wed	04/23/08	6:55 AM	2,471.2	8,235.2	13.9	14.3	7.0	NR	NA	33	21	27	16	12	6	17	385	2,936.8	325,200	384	1303	1252	2009.5	24.9	2.8	0.8	5.0	0.8
	Thu	04/24/08	7:00 AM	2,483.4	8,248.3	12.2	13.1	8.0	NR	NA	39	30	50	15	9	-11	24	296	3,225.3	288,500	381	1306	1254	2061.4	51.9	1.2	0.0	0.9	0.0
	Fri	04/25/08	7:00 AM	2,495.6	8,259.8	12.2	11.5	6.0	NR	NA	32	22	27	17	10	5	15	386	217.4	NA	#VALUE!	1308	1257	2080.0	18.6	2.5	0.5	4.4	0.0
	Sat	04/26/08	8:00 AM	2,507.1	8,271.0	11.5	11.2	5.0	NR	NA	36	20	26	17	16	10	19	372	473.8	256,400	377	1310	1259	2093.6	13.6	3.8	1.4	7.0	2.4
	Sun	04/27/08	8:00 AM	2,518.6	8,282.7	11.5	11.7	5.0	NR	NA	4	12	10	10	-8	-6	-6	NR	731.5	257,700	370	1312	1261	2108.2	14.6	3.9	1.4	8.2	4.1
91	Mon	04/28/08	7:00 AM	2,530.3	8,294.5	11.7	11.8	5.0	NR	NA	32	23	28	18	9	4	14	401	996.1	264,600	375	1314	1263	2127.7	19.5	3.3	0.1	5.5	0.0
	Tue	04/29/08	7:00 AM	2,543.9	8,308.3	13.6	13.8	NR	NR	NA	44	42	44	NR	2	0	NA	122	1,297.2	301,100	366	1316	1265	2154.3	26.6	3.7	0.8	4.5	0.0
	Wed	04/30/08	7:00 AM	2,557.2	8,321.6	13.3	13.3	8.0	NR	NA	34	24	21	17	10	13	17	363	1,593.4	296,200	371	1319	1267	2182.9	28.6	2.7	3.0	5.0	5.0
	Thu	05/01/08	7:10 AM	2,570.7	8,335.6	13.5	14.0	10.0	NR	NA	32	28	20	17	4	12	15	390	1,915.6	322,200	391	1323	1271	2211.5	28.6	0.3	2.9	0.0	0.4
	Fri	05/02/08	7:00 AM	2,584.4	8,348.0	13.7	12.4	10.0	NR	NA	33	21	27	16	12	6	17	382	2,228.8	313,200	401	1325	1274	2214.3	2.8	2.7	0.9	4.4	0.1
	Sat	05/03/08	8:30 AM	2,595.7	8,354.8	11.3	6.8	4.0	NR	NA	39	32	0	15	7	39	24	318	2,469.3	240,500	472	1328	1276	2245.8	31.5	0.9	0.0	0.1	0.0
	Sun	05/04/08	8:50 AM	2,607.3	8,370.9	11.6	16.1	9.0	NR	NA	34	27	21	16	7	13	18	386	2,728.6	259,300	320	1330	1278	2260.0	14.2	1.3	4.0	1.5	7.7
92	Mon	05/05/08	7:00 AM	2,618.6	8,381.8	11.3	10.9	8.0	NR	NA	4	11	9	10	-7	-5	-6	0	2,978.6	250,000	375	1332	1280	2274.0	14.0	0.3	3.3	0.6	6.1
	Tue	05/06/08	7:00 AM	2,630.7	8,393.2	12.1	11.4	8.0	NR	NA	35	25	21	15	10	14	20	367	3,247.1	268,500	381	1333	1282	2285.4	11.4	0.0	3.3	0.0	6.0
	Wed	05/07/08	7:00 AM	2,642.4	8,404.9	11.7	11.7	8.0	NR	NA	32	27	21	17	5	11	15	388	242.4	NA	#VALUE!	1336	1284	2313.9	28.5	1.1	3.7	0.0	4.3
	Thu	05/08/08	7:00 AM	2,655.6	8,418.3	13.2	13.4	8.0	NR	NA	32	29	21	18	3	11	14	381	556.2	313,800	393	1340	1288	2353.4	39.5	0.5	2.6	0.0	3.3
	Fri	05/09/08	7:00 AM	2,668.9	8,431.6	13.3	13.3	9.0	NR	NA	32	23	27	17	9	5	15	391	867.5	311,300	390	1342	1291	2383.6	30.2	3.8	1.0	4.0	0.6
	Sat	05/10/08	7:00 AM	2,682.2	8,444.6	13.3	13.0	10.0	NR	NA	34	27	20	16	7	14	18	370	1,153.5	286,000	363	1344	1292	2399.8	16.2	2.3	7.5	4.9	5.8
	Sun	05/11/08	7:00 AM	2,696.7	8,458.4	14.5	13.8	11.0	NR	NA	35	21	23	16	14	12	19	360	1,466.5	313,000	369	1345	1294	2410.6	10.8	9.6	6.5	4.8	5.4
93	Mon	05/12/08	7:00 AM	2,712.0	8,473.0	15.3	14.6	11.0	NR	NA	34	27	20	16	7	14	18	383	1,805.1	338,600	378	1348	1296	2429.3	18.7	1.5	1.2	5.8	4.6
	Tue	05/13/08	7:00 AM	2,725.1	8,486.8	13.1	13.8	8.0	NR	NA	33	29	20	17	4	13	16	381	2,119.7	314,600	390	1351	1299	2461.2	31.9	0.2	2.9	0.0	5.0
	Wed	05/14/08	7:10 AM	2,737.0	8,498.8	11.9	12.0	9.0	NR	NA	33	30	19	17	3	14	16	395	2,394.7	275,000	384	1353	1301	2475.8	14.6	0.2	5.7	0.0	5.9
	Thu	05/15/08	7:40 AM	2,748.1	8,509.2	11.1	10.4	9.0	NR	NA	33	26	21	17	7	12	16	386	2,644.1	249,400	387	1354	1303	2486.2	10.4	4.0	5.0	5.7	5.7
	Fri	05/16/08	7:05 AM	2,760.0	8,520.5	11.9	11.3	8.0	NR	NA	35	21	24	16	14	11	19	354	2,907.0	262,900	378	1355	1305	2507.0	20.8	7.6	6.0	3.5	4.8
	Sat	05/17/08	NR	2,771.2	8,531.4	11.2	10.9	8.0	NR	NA	34	27	20	16	7	14	18	370	3,180.2	273,200	412	1357	1307	2529.1	22.1	2.3	7.4	4.8	5.6
	Sun	05/18/08	8:30 AM	2,782.6	8,543.9	11.4	12.5	7.0	NR	NA	32	25	24	17	7	8	15	404	165.6	NA	#VALUE!	1359	1309	2551.7	22.6	4.8	4.1	5.6	5.1
94	Mon	05/19/08	7:00 AM	2,794.7	8,556.5	12.1	12.6	9.0	NR	NA	32	22	23	16	10	9	16	370	448.8	283,200	382	1361	1311	2565.3	13.6	5.3	4.7	4.3	4.2
	Tue	05/20/08	6:55 AM	2,804.7	8,567.0	10.0	10.5	8.0	NR	NA	35	22	23	16	13	12	19	347	705.3	256,500	417	1363	1313	2579.5	14.2	4.4	6.6	2.3	6.1
	Wed	05/21/08	7:00 AM	2,815.8	8,578.1	11.1	11.1	4.0	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	970.9	265,600	399	1365	1315	2593.7	14.2	4.8	6.2	3.7	6.2
	Thu	05/22/08	6:50 AM	2,826.5	8,589.0	10.7	10.9	4.0	NR	NA	32	31	21	16	1	11	16	390	1,223.6	252,700	390	1368	1317	2610.4	16.7	0.0	0.0	3.3	6.2
	Fri	05/23/08	7:00 AM	2,836.9	8,599.1	10.4	10.1	7.0	NR	NA	35	21	23	16	14	12	19	367	1,461.9	238,300	388	1369	1319	2620.8	10.4	5.1	7.6	3.3	6.7
	Sat	05/24/08	7:45 AM	2,845.8	8,608.0	8.9	8.9	7.0	NR	NA	31	25	27	17	6	4	14	410	1,685.1	223,200	418	1371	1321	2634.3	13.5	3.4	7.7	1.1	3.5
	Sun	05/25/08	7:00 AM	2,856.9	8,619.6	11.1	11.6	9.0	NR	NA	29	24	25	16	5	4	13	433	1,940.6	255,500	375	1373	1323	2646.9	12.6	1.9	5.6	0.5	1.1
95	Mon	05/26/08	7:00 AM	2,869.5	8,631.6	12.6	12.0	10.0	NR	NA	30	25	28	16	5	2	14	422	2,229.0	288,400	391	1375	1325	2660.0	13.1	2.1	4.3	0.2	0.0
	Tue	05/27/08	7:00 AM	2,882.6	8,644.7	13.1	13.1	10.0	NR	NA	32	23	29	17	9	3	15	408	2,532.2	303,200	386	1377	1327	2673.0	13.0	3.1	0.3	5.5	0.0
	Wed	05/28/08	6:45 AM	2,895.5	8,657.5	12.9	12.8	7.0	NR	NA	30	24	28	17	6	2	13	426	2,830.5	298,300	387	1380	1330	2692.8	19.8	1.7	0.0	2.2	0.0
	Thu	05/29/08	7:00 AM	2,908.5	8,670.5	13.0	13.0	10.0	NR	NA	32	23	26	17	9	6	15	403	3,139.4	308,900	396	1383	1333	2715.7	22.9	2.2	1.0	4.6	1.2
	Fri	05/30/08	7:10 AM	2,920.6	8,683.2	12.1	12.7	9.0	NR	NA	5	13	10	10	-8	-5	-5	0	155.2	NA	#VALUE!	1385	1335	2725.3	9.6	4.8	2.9	5.6	5.5
	Sat	05/31/08	8:40 AM	2,932.5	8,695.0	11.9	11.8	9.0	NR	NA	35	22	23	16	13	12	19	351	437.8	282,600	397	1387	1337	2738.4	13.1	5.2	5.1	7.2	7.3
	Sun	06/01/08	8:30 AM	2,945.7	8,706.8	13.2	11.8	8.0	NR	NA	31	25	21	18	6	10	13	396	719.8	282,000	377	1389	1339	2750.9	12.5	3.7	0.8	6.5	2.1
96	Mon	06/02/08	6:50 AM	2,957.0	8,718.5	11.3	11.7	0.0	NR	NA	34	24	24	16	10	10	18	383	993.1	273,300	396	1390	1340	2757.2	6.3	9.0	8.2	3.9	6.8
	Tue	06/03/08	7:00 AM	2,969.2	8,730.5	12.2	12.0	NR	NR	NA	32	30	21	16	2	11	16	402	1,261.3	268,200	369	1392	1341	2766.8	9.6	0.9	1.5	7.9	8.0
	Wed	06/04/08	7:15 AM	2,982.3	8,742.7	13.1	12.2	NR	NR	NA	31	30	22	17	1	9	14	411	1,551.0	289,700	382	1394	1343	2779.9	13.1	0.2	3.8	0.2	6.1
	Thu	06/05/08	7:10 AM	2,993.6	8,753.8	11.3	11.1	7.0	NR	NA	33	24	24	17	9	9	16	398	1,811.1	260,100	387	1395	1345	2789.5	9.6	5.1	3.1	6.2	6.2
	Fri	06/06/08	7:00 AM	3,005.2	8,766.2	11.6	12.4	33.0	NR	NA	30	25	27	18	5	3	12	412	2,080.7	269,600	375	1397	1347	2802.4	12.9	3.0	0.7	5.2	1.1
	Sat	06/07/08	8:00 AM	3,016.6	8,779.3	11.4	13.1	NR	NR	NA	33	25	27	18	8	6	15	400	2,381.1	300,400	411	1399	1349	2814.9	12.5	2.5	0.7	4.1	0.1
	Sun	06/08/08	8:00 AM	3,030.1	8,791.4	13.5	12.1	NR	NR	NA	38	33	0	15	5	38	23	318	2,646.7	265,600	347	1401	1350	2824.3	9.4	1.2	1.8	0.0	0.0
97	Mon	06/09/08	7:00 AM	3,042.2	8,803.8	12.1	12.4	NR	NR	NA	32	31	20	16	1	12	16	402	2,930.8	284,100	387	1403	1352	2837.0	12.7	0.2	0.0	6.1	5.0
	Tue	06/10/08	6:50 AM	3,055.8	8,816.0	13.6	12.2	NR	NR	NA	30	30	23	16	0	7	14	422	3,228.2	297,400	385	1404	1355	2849.6	12.6	0.0	0.0	2.2	4.4
	Wed	06/11/08	6:50 AM	3,066.1	8,825.8	10.3	9.8	8.0	NR	NA	35	23	23	16	12	12	19	367	201.7	NA	#VALUE!	1406	1357	2862.7	13.1	4.5	6.5	3.3	6.4
	Thu	06/12/08	6:55 AM	3,078.3	8,637.9	12.2	-187.9	9.0	NR	NA	38	48	32	15	-10	6	23	312	493.7	292,000	187	1408	1360	2880.6	17.9	0.0	0.0	0.6	0.0
	Fri	06/13/08	7:00 AM	3,090.1	8,850.1	11.8	212.2	NR	NR	NA	41	50	21	15	-9	20	26	248	766.7	273,000	204	1410	1362	2894.7	14.1	0.0	3.5	0.0	5.7
	Sat	06/14/08	9:00 AM	3,102.7	8,862.1	12.6	12.0	NR	NR	NA	33	22	28	17	11	5	16	391	1,054.6	287,900	390	1412	1365	2907.2	12.5	5.0	1.1	7.8	0.7
	Sun	06/15/08	6:30 AM	3,112.8	8,872.6	10.1	10.5	NR	NR	NA	33	10	10	NR	23	23	NA	NR	1,287.2	232,600	377	1414	1366	2916.8	9.6	0.0	5.6	0.4	8.8

Table A-1. US EPA Arsenic Demonstration Project at Arnaudville, LA - Daily System Operation Log Sheet (Continued)

Week No.	Day of Week	Date	Time	Tank A Hour Meter (hrs)	Tank B Hour Meter (hrs)	TA Run Time (hrs)	TB Run Time (hrs)	$KMnO_4$ Tank 1 Level[(a)] (inches)	$KMnO_4$ Tank 2 Level (Iron) (inches)	Estimated $KMnO_4$ Dosage (μg/L as Mn)	Pressure Filtration: Influent (psig)	Outlet Tank A (psig)	Outlet Tank B (psig)	Effluent (psig)	Inlet-TA (psig)	Inlet-TB (psig)	Inlet-Effluent (psig)	Flow rate (gpm)	Totalizer to Distribution (kgal)	Gallon Usage (gal)	Daily Average Flowrate (gpm)	Backwash: Tank A No.	Tank B No.	Total Volume (kgal)	Daily Volume (kgal)	Since Last BW: Run Time Tank A (hrs)	Run Time Tank B (hrs)	Standby Time Tank A (hrs)	Standby Time Tank B (hrs)
	Mon	06/16/08	7:00 AM	3,124.9	8,884.7	12.1	12.1	NR	NR	NA	40	28	3	15	12	37	25	283	1,564.0	276,800	381	1415	1368	2926.0	9.2	3.6	6.8	0.0	0.0
	Tue	06/17/08	8:30 AM	3,141.4	8,900.2	16.5	15.5	NR	NR	NA	33	23	26	16	10	7	17	402	1,935.4	371,400	387	1417	1371	2941.6	15.6	7.2	3.7	3.6	3.0
	Wed	06/18/08	6:55 AM	3,155.4	8,914.9	14.0	14.7	NR	NR	NA	31	24	27	16	7	4	15	404	2,249.5	314,100	365	1419	1373	2954.5	12.9	3.7	5.5	1.2	1.4
98	Thu	06/19/08	6:50 AM	3,169.6	8,928.9	14.2	14.0	6.0	NR	NA	33	31	26	15	2	7	18	403	2,566.5	317,000	375	1422	1376	2973.7	19.2	0.7	0.0	3.2	3.9
	Fri	06/20/08	7:00 AM	3,184.1	8,942.2	14.5	13.3	10.0	NR	NA	41	5	24	15	36	17	26	242	2,880.0	313,500	377	1423	1378	2983.4	9.7	0.0	5.4	0.0	5.6
	Sat	06/21/08	8:30 AM	3,204.9	8,962.2	20.8	20.0	1.0	NR	NA	29	17	20	15	12	9	14	250	3,204.5	324,500	265	1424	1380	2992.5	9.1	20.8	6.8	4.1	3.7
	Sun	06/22/08	9:00 AM	3,226.1	8,983.3	21.2	21.1	NR	NR	NA	41	36	35	0	5	6	41	95	248.8	NA	#VALUE!	1425	1381	2999.0	6.5	20.4	11.4	2.3	2.3
	Mon	06/23/08	7:00 AM	3,247.6	9,004.1	21.5	20.8	NR	NR	NA	40	40	40	0	0	0	40	105	557.0	308,200	243	1426	1383	3008.5	9.5	17.9	2.0	0.0	0.0
	Tue	06/24/08	7:00 AM	3,262.6	9,019.3	15.0	15.2	NR	NR	NA	33	22	24	16	11	9	17	375	892.6	335,600	370	1428	1385	3021.6	13.1	0.6	3.6	4.3	2.2
	Wed	06/25/08	7:05 AM	3,276.1	9,032.7	13.5	13.4	NR	NR	NA	32	23	28	16	9	4	16	393	1,206.4	313,800	389	1430	1388	3037.5	15.9	5.1	0.5	3.6	0.0
99	Thu	06/26/08	7:15 AM	3,289.4	9,045.7	13.3	13.0	NR	NR	NA	5	13	10	10	-8	-5	-5	0	1,524.2	317,800	403	1432	1390	3050.2	12.7	2.7	1.4	2.8	1.2
	Fri	06/27/08	7:05 AM	3,304.5	9,060.1	15.1	14.4	9.0	NR	NA	39	55	32	16	-16	7	23	303	1,863.5	339,300	384	1434	1394	3070.1	19.9	0.0	1.2	0.0	0.0
	Sat	06/28/08	8:00 AM	3,321.2	9,075.7	16.7	15.6	NR	NR	NA	39	44	44	0	-5	-5	39	117	2,221.6	358,100	370	1436	1397	3084.6	14.5	8.2	4.3	1.2	0.0
	Sun	06/29/08	8:00 AM	3,338.2	9,092.1	17.0	16.4	NR	NR	NA	38	33	2	15	5	36	23	312	2,603.9	382,300	382	1439	1399	3100.8	16.2	1.7	1.2	0.0	0.0
	Mon	06/30/08	7:05 AM	3,353.4	9,107.2	15.2	15.1	NR	NR	NA	4	13	10	10	-9	-6	-6	0	2,975.0	371,100	408	1441	1402	3125.7	24.9	1.8	3.4	1.2	1.2
	Tue	07/01/08	7:00 AM	3,372.0	9,125.9	18.6	18.7	NR	NR	NA	23	22	16	15	1	7	8	270	3,271.7	296,700	265	1442	1403	3137.5	11.8	2.9	11.8	3.2	3.2
	Wed	07/02/08	7:05 AM	3,389.1	9,141.4	17.1	15.5	NR	NR	NA	26	16	18	14	10	8	12	238	266.8	NA	#VALUE!	1442	1405	3144.0	6.5	19.9	5.8	9.5	3.1
100	Thu	07/03/08	7:15 AM	3,408.6	9,161.0	19.5	19.6	NR	NR	NA	28	18	18	15	10	10	13	254	560.8	294,000	251	1443	1406	3152.3	8.3	17.5	3.5	9.7	2.7
	Fri	07/04/08	7:15 AM	3,427.3	9,179.9	18.7	18.9	3.5	NR	NA	33	24	0	15	9	33	18	216	833.0	272,200	241	1445	1407	3162.1	9.8	3.7	3.1	0.0	0.0
	Sat	07/05/08	7:00 AM	3,442.3	9,194.9	15.0	15.0	6.0	NR	NA	29	27	26	17	2	3	12	442	1,119.7	286,700	319	1447	1410	3178.3	16.2	1.7	5.1	1.0	3.4
	Sun	07/06/08	7:00 AM	3,461.6	9,214.2	19.3	19.3	NR	NR	NA	24	19	16	NR	5	8	NA	244	1,414.8	295,100	255	1448	1411	3184.6	6.3	11.3	3.1	13.8	3.0
	Mon	07/07/08	7:15 AM	3,482.5	9,234.5	20.9	20.3	NR	NR	NA	22	18	18	15	4	4	7	258	1,733.1	318,300	258	1449	1413	3194.3	9.7	13.8	2.4	6.4	2.4
	Tue	07/08/08	6:50 AM	3,504.8	9,257.3	22.3	22.8	NR	NR	NA	21	22	15	15	-1	6	6	250	2,049.1	316,000	234	1451	1414	3204.1	9.8	0.1	1.8	0.0	0.0
	Wed	07/09/08	7:00 AM	3,528.6	9,280.9	23.8	23.6	6.0	NR	NA	26	22	14	15	4	12	11	239	2,381.9	332,800	234	1452	1415	3210.8	6.7	5.3	0.0	17.4	8.0
101	Thu	07/10/08	7:00 AM	3,550.6	9,302.2	22.0	21.3	3.0	NR	NA	25	22	16	15	3	9	10	270	2,688.0	306,100	236	1453	1417	3222.3	11.5	4.3	1.0	11.2	1.0
	Fri	07/11/08	7:00 AM	3,570.3	9,321.9	19.7	19.7	2.0	NR	NA	24	21	15	15	3	9	9	249	2,973.9	285,900	242	1454	1418	3228.9	6.6	5.0	15.3	0.3	3.2
	Sat	07/12/08	8:15 AM	3,590.3	9,341.1	20.0	19.2	3.0	NR	NA	41	42	41	0	-1	0	41	98	3,273.9	300,000	255	1455	1420	3238.6	9.7	12.0	2.9	4.7	2.9
	Sun	07/13/08	8:20 AM	3,611.8	9,363.1	21.5	22.0	3.0	NR	NA	45	43	41	0	2	4	45	103	303.8	-2,970,100	-2,276	1456	1421	3245.2	6.6	15.1	8.2	1.6	1.6
	Mon	07/14/08	7:30 AM	3,632.6	9,383.7	20.8	20.6	3.0	NR	NA	46	38	36	0	8	10	46	91	608.2	304,400	245	1457	1422	3251.8	6.6	NR	11.2	1.4	1.4
	Tue	07/15/08	7:00 AM	3,654.0	9,405.6	21.4	21.9	3.0	NR	NA	30	28	36	14	2	-6	16	212	908.7	300,500	231	1460	1424	3268.1	16.3	5.6	19.6	0.0	0.0
	Wed	07/16/08	6:50 AM	3,676.1	9,428.0	22.1	22.4	3.0	NR	NA	28	24	31	15	4	-3	13	230	1,181.2	272,500	204	1463	1425	4.1	NA	3.0	18.6	0.0	0.0
102	Thu	07/17/08	7:00 AM	3,692.0	9,447.1	15.9	19.1	4.0	NR	NA	32	21	23	15	11	9	17	403	1,513.0	331,800	319	1469	1428	33.2	29.1	2.5	1.6	2.2	2.3
	Fri	07/18/08	7:00 AM	3,707.1	9,462.3	15.1	15.2	2.0	NR	NA	22	22	14	14	0	8	8	270	1,815.8	302,800	333	1472	1431	51.8	18.6	1.0	6.1	0.0	3.3
	Sat	07/19/08	11:00 AM	3,731.1	9,485.7	24.0	23.4	3.0	NR	NA	22	17	20	16	5	2	6	264	2,161.1	345,300	243	1473	1433	61.5	9.7	9.7	1.9	2.7	0.0
	Sun	07/20/08	10:00 AM	3,753.0	9,507.6	21.9	21.9	3.0	NR	NA	22	18	20	17	4	2	5	275	2,474.6	313,500	239	1474	1434	68.0	6.5	13.0	4.8	0.7	0.7
	Mon	07/21/08	6:55 AM	3,773.0	9,527.7	20.0	20.1	3.0	NR	NA	25	17	19	15	8	6	10	261	2,779.4	304,800	253	1475	1435	74.6	6.6	14.2	6.5	0.0	0.0
	Tue	07/22/08	7:05 AM	3,796.2	9,550.0	23.2	22.3	3.0	NR	NA	22	17	20	15	5	2	7	262	3,112.1	332,700	244	1476	1437	84.4	9.8	13.3	1.8	0.0	0.0
	Wed	07/23/08	7:10 AM	3,817.2	9,570.5	21.0	20.5	3.0	NR	NA	25	18	18	15	7	7	10	265	141.1	NA	#VALUE!	1477	1438	90.7	6.3	14.0	6.6	2.5	2.6
103	Thu	07/24/08	7:00 AM	3,839.1	9,593.4	21.9	22.9	4.0	NR	NA	22	22	14	15	0	8	7	247	468.9	327,800	244	1479	1439	100.3	9.6	1.8	13.6	0.0	0.0
	Fri	07/25/08	7:10 AM	3,862.8	9,616.5	23.7	23.1	3.0	NR	NA	20	18	19	15	2	1	5	262	810.0	341,100	243	1480	1441	110.0	9.7	8.0	1.5	0.0	0.0
	Sat	07/26/08	8:00 AM	3,878.3	9,632.2	15.5	15.7	3.0	NR	NA	39	51	26	13	-12	13	26	288	1,201.5	391,500	418	1484	1446	141.4	31.4	0.0	1.5	0.0	1.4
	Sun	07/27/08	8:00 AM	3,891.3	9,644.5	13.0	12.3	3.0	NR	NA	27	27	23	16	0	4	11	449	1,527.6	326,100	430	1488	1451	167.2	25.8	0.2	1.0	0.0	0.0
	Mon	07/28/08	7:00 AM	3,904.4	9,656.6	13.1	12.1	3.0	NR	NA	28	25	26	16	3	2	12	156	1,855.2	327,600	434	1490	1455	185.6	18.4	1.7	0.4	2.4	0.0
	Tue	07/20/08	7:15 AM	3,918.0	9,670.1	13.6	13.5	5.0	NR	NA	5	12	10	10	-7	-5	-5	0	2,190.6	335,400	413	1495	1461	220.4	34.8	0.4	1.0	0.6	0.6
	Wed	07/30/08	7:05 AM	3,932.6	9,683.7	14.6	13.6	3.0	NR	NA	7	13	10	10	-6	-3	-3	0	2,535.4	344,800	408	1497	1464	235.9	15.5	2.6	0.6	2.4	0.0
104	Thu	07/31/08	7:10 AM	3,946.3	9,697.2	13.7	13.5	4.0	NR	NA	29	24	24	15	5	5	14	405	2,873.3	337,900	414	1500	1467	254.4	18.5	2.2	1.5	1.5	0.9
	Fri	08/01/08	7:20 AM	3,958.7	9,709.5	12.4	12.3	3.0	NR	NA	7	13	10	10	-6	-3	-3	0	3,181.0	307,700	415	1503	1471	275.4	21.0	1.3	0.7	0.0	0.0
	Sat	08/02/08	10:00 AM	3,972.0	9,722.0	13.3	12.5	4.0	NR	NA	6	13	10	10	-7	-4	-4	0	232.1	NA	#VALUE!	1505	1474	290.6	15.2	3.3	1.9	2.1	0.8
	Sun	08/03/08	10:00 AM	3,984.1	9,733.5	12.1	11.5	4.0	NR	NA	30	22	26	15	8	4	15	407	514.3	282,200	399	1507	1477	305.8	15.2	3.5	0.8	7.5	0.0
	Mon	08/04/08	7:00	3,995.4	9,744.5	11.3	11.0	3.0	NR	NA	30	24	25	16	6	5	14	411	777.1	262,800	393	1509	1479	318.0	12.2	3.2	0.9	5.9	1.9
	Tue	08/05/08	7:30 AM	4,005.4	9,755.2	10.0	10.7	0.0	NR	NA	3	10	7	7	-7	-4	-4	0	1,024.7	247,600	399	1511	1481	330.0	12.0	4.1	2.4	7.3	7.3
	Wed	08/06/08	6:55 AM	4,015.7	9,765.4	10.3	10.2	0.0	NR	NA	32	24	23	15	8	9	17	381	1,284.0	259,300	422	1513	1483	342.2	12.2	4.3	3.4	7.1	7.1
105	Thu	08/07/08	7:05 AM	4,029.7	9,778.8	14.0	13.4	0.0	NR	NA	39	6	26	14	33	13	25	287	1,604.6	320,600	390	1515	1486	357.1	14.9	0.0	0.0	3.2	5.0
	Fri	08/08/08	6:50 AM	4,043.6	9,792.4	13.9	13.6	NR	NR	NA	30	29	21	15	1	9	15	402	1,928.9	324,300	393	1518	1489	375.3	18.2	0.3	2.0	0.3	3.8
	Sat	08/09/08	6:45 AM	4,057.1	9,804.6	13.5	12.2	NR	NR	NA	29	28	24	15	1	5	14	396	2,227.9	299,000	389	1520	1492	391.1	15.8	0.5	1.1	1.0	2.9
	Sun	08/10/08	7:30 AM	4,071.5	9,818.5	14.4	13.9	NR	NR	NA	28	28	23	16	0	5	12	408	2,550.8	322,900	380	1522	1495	406.1	15.0	0.1	1.4	0.1	1.3
	Mon	08/11/08	6:55 AM	4,085.4	9,832.2	13.9	13.7	NR	NR	NA	28	28	23	15	0	5	13	401	2,859.7	308,900	373	1524	1499	421.4	15.3	0.0	1.5	0.0	1.2
	Tue	08/12/08	7:00 AM	4,099.3	9,845.8	13.9	13.6	NR	NR	NA	28	28	24	17	0	4	11	409	3,158.1	298,400	362	1526	1501	436.8	15.4	0.1	1.1	0.0	0.7
	Wed	08/13/08	7:00 AM	4,111.3	9,857.7	12.0	11.9	NR	NR	NA	40	3	26	14	37	14	26	280	154.1	-3,004,000	-4,190	1527	1503	445.7	8.9	0.0	2.5	0.0	5.1
106	Thu	08/14/08	6:50 AM	4,123.6	9,870.2	12.3	12.5	NR	NR	NA	32	22	25	15	10	7	17	375	437.6	283,500	381	1529	1506	460.7	15.0	5.0	1.7	5.8	2.8
	Fri	08/15/08	6:50 AM	4,136.8	9,882.7	13.2	12.5	NR	NR	NA	32	16	21	15	16	11	17	321	733.1	295,500	384	1531	1509	475.5	14.8	0.0	0.3	0.0	0.0
	Sat	08/16/08	7:50 AM	4,155.5	9,901.5	18.7	18.8	NR	NR	NA	23	18	20	15	5	3	8	266	1,025.7	292,600	260	1533	1511	488.1	12.6	6.8	1.9	3.6	0.5
	Sun	08/17/08	7:00 AM	4,176.9	9,922.6	21.4	21.1	NR	NR	NA	30	6	20	15	24	10	15	220	1,338.1	312,400	245	1534	1513	496.8	8.7	0.0	5.0	0.0	1.2
	Mon	08/18/08	7:10 AM	4,200.0	9,945.1	23.1	22.5	NR	NR	NA	22	17	18	15	5	4	7	248	166.8	-1,171,300	-856	1536	1515	524.4	27.6	8.5	3.3	0.0	0.0
	Tue	08/19/08	7:00 AM	4,219.6	9,963.8	19.6	18.7	NR	NR	NA	29	24	26	16	5	3	13	412	2,017.2	1,850,400	1,611	1538	1518	565.8	41.4	2.9	0.6	0.5	0.6
	Wed	08/20/08	7:00 AM	4,238.9	9,983.2	19.3	19.4	NR	NR	NA	26	20	15	15	6	11	11	244	2,312.5	295,300	254	1539	1519	581.9	16.1	6.6	12.6	2.8	2.8
107	Thu	08/21/08	7:00 AM	4,259.0	10,002.4	20.1	19.2	NR	NR	NA	23	18	19	15	5	4	8	260	2,597.2	284,700	242	1540	1521	606.7	24.8	10.6	4.6	1.4	1.4
	Fri	08/22/08	7:10 AM	4,278.8	10,022.0	19.8	19.6	0.0	NR	NA	30	22	48	15	8	-18	15	398	2,880.6	283,400	240	1541	1522	624.6	17.9	8.0	0.0	1.5	0.0
	Sat	08/23/08	9:50 AM	4,294.8	10,037.4	16.0	15.4	NR	NR	NA	42	44	43	17	-2	-1	25	173	3,219.8	339,200	360	1544	1526	681.6	57.0	2.6	1.2	0.0	0.0
	Sun	08/24/08	8:30 AM	4,309.4	10,051.7	14.6	14.3	NR	NR	NA	42	43	39	NR	-1	3	NA	159	259.3	NA	#VALUE!	1546	1528	715.5	33.9	2.0	3.1	1.9	3.9
	Mon	08/25/08	7:00 AM	4,322.7	10,064.9	13.3	13.2	NR	NR	NA	30	25	25	16	5	5	14	398	566.4	307,100	386	1548	1531	756.7	41.2	2.3	1.4	2.7	0.6
	Tue	08/26/08	7:00 AM	4,337.9	10,079.4	15.2	14.5	NR	NR	NA	31	23	26	16	8	5	15	384	893.6	327,200	367	1550	1534	798.1	41.4	3.2	1.4	3.7	0.6
	Wed	08/27/08	7:00 AM	4,354.5	10,096.4	16.6	17.0	NR	NR	NA	29	27	24	16	2	5	13	415	1,267.3	373,700	371	1553	1537	847.6	49.5	0.9	2.2	0.5	0.5
108	Thu	08/28/08	7:00 AM	4,369.4	10,110.8	14.9	14.4	NR	NR	NA	44	44	42	0	0	2	44	128	1,586.9	319,600	364	1555	1540	889.5	41.9	2.8	2.3	2.4	2.1
	Fri	08/29/08	NR	NR	NR	NA	NA	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	NR	NA	#VALUE!	NR	NR	NR	NA	NR	NR	NR	NR
	Sat	08/30/08	11:30 AM	4,402.4	10,141.4	NA	NA	NR	NR	NA	43	18	0	12	25	43	31	165	2,283.0	NA	#VALUE!	1574	1566	958.6	NA	0.0	0.0	0.0	0.0
	Sun	08/31/08	8:00 AM	4,415.1	10,158.5	12.7	17.1	NR	NR	NA	7	15	13	10	-8	-6	-3	0	2,309.3	NA	#VALUE!	1584	1567	958.6	0.0	12.2	17.2	6.2	6.2

Table A-1. US EPA Arsenic Demonstration Project at Arnaudville, LA - Daily System Operation Log Sheet (Continued)

Week No.	Day of Week	Date	Time	Tank A Hour Meter hrs	Tank B Hour Meter hrs	TA Run Time hrs	TB Run Time hrs	$KMnO_4$ Tank 1 Level[(a)] inches	$KMnO_4$ Tank 2 Level (Iron) inches	Estimated $KMnO_4$ Dosage µg/L as Mn	Pressure Filtration: Influent psig	Outlet Tank A psig	Outlet Tank B psig	Effluent psig	Inlet-TA psig	Inlet-TB psig	Inlet-Effluent psig	Flow rate gpm	Totalizer to Distribution kgal	Gallon Usage gal	Daily Average Flowrate gpm	Backwash: Tank A No.	Tank B No.	Total Volume kgal	Daily Volume kgal	Since Last BW: Run Time Tank A hrs	Run Time Tank B hrs	Standby Time Tank A hrs	Standby Time Tank B hrs
109	Mon	09/01/08	NR	NR	NR	NA	NA	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	NR	NA	#VALUE!	NR	NR	NR	NA	NR	NR	NR	NR
	Tue	09/02/08	NR	NR	NR	NA	NA	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	NR	NA	#VALUE!	NR	NR	NR	NA	NR	NR	NR	NR
	Wed	09/03/08	NR	NR	NR	NA	NA	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	NR	NA	#VALUE!	NR	NR	NR	NA	NR	NR	NR	NR
	Thu	09/04/08	1:30 AM	4,426.9	10,165.3	NA	NA	NR	NR	NA	5	10	17	10	-5	-12	-5	0	2,310.1	NA	#VALUE!	1584	1567	958.6	NA	0.0	0.0	0.0	0.0
	Fri	09/05/08	7:00 AM	4,426.9	10,165.3	0.0	0.0	NR	NR	NA	13	8	10	15	5	3	-2	0	2,310.1	0	#DIV/0!	1584	1567	958.6	0.0	0.0	0.0	0.0	0.0
	Sat	09/06/08	5:30 AM	4,439.5	10,175.0	12.6	9.7	NR	NR	NA	38	16	13	13	22	25	25	0	2,620.6	310,500	472	1593	1583	1042.5	83.9	0.0	0.0	0.0	0.0
	Sun	09/07/08	8:00 AM	4,439.5	10,175.2	0.0	0.2	NR	NR	NA	20	24	22	23	-4	-2	-3	0	2,629.8	9,200	#DIV/0!	1594	1584	1049.0	6.5	0.4	0.0	0.0	0.0
110	Mon	09/08/08	NR	4,439.5	10,175.2	0.0	0.0	NR	NR	NA	19	23	21	NR	-4	-2	NA	0	2,629.8	NA	#VALUE!	1594	1584	1049.0	0.0	0.4	0.0	0.0	0.0
	Tue	09/09/08	7:00 AM	4,451.0	10,186.4	11.5	11.2	NR	NR	NA	31	25	21	NR	6	10	NA	380	2,905.6	275,800	405	1595	1585	1060.7	11.7	8.9	9.1	8.9	8.4
	Wed	09/10/08	7:00 AM	4,464.1	10,198.6	13.1	12.2	NR	NR	NA	32	25	22	NR	7	10	NA	375	3,189.7	284,100	375	1595	1585	1060.7	0.0	22.0	10.0	18.2	10.0
	Thu	09/11/08	6:00 AM	4,477.4	10,211.2	13.3	12.6	NR	NR	NA	5	13	10	NR	-8	-5	NA	0	206.7	NA	#VALUE!	1596	1587	1071.3	10.6	12.8	0.7	8.5	0.1
	Fri	09/12/08	6:55 AM	4,489.1	10,222.9	11.7	11.7	NR	NR	NA	31	24	26	NR	7	5	NA	386	488.4	281,700	401	1597	1588	1078.4	7.1	10.1	2.7	9.4	4.4
	Sat	09/13/08	9:00 AM	4,502.7	10,236.0	13.6	13.1	NR	NR	NA	32	24	25	NR	8	7	NA	389	794.7	306,300	383	1598	1589	1085.9	7.5	10.6	6.2	8.7	6.8
	Sun	09/14/08	9:00 AM	4,516.0	10,249.4	13.3	13.4	NR	NR	NA	4	13	11	NR	-9	-7	NA	0	1,093.4	298,700	373	1599	1590	1093.1	7.2	10.9	7.4	9.3	8.7
111	Mon	09/15/08	6:45 AM	4,528.5	10,261.6	12.5	12.2	NR	NR	NA	33	25	23	16	8	10	17	364	1,375.6	282,200	381	1600	1591	1100.2	7.1	11.2	8.8	7.8	7.8
	Tue	09/16/08	6:45 AM	4,541.0	10,273.9	12.5	12.3	NR	NR	NA	4	13	10	11	-9	-6	-7	0	1,659.9	284,300	382	1601	1593	1110.7	10.5	9.4	2.6	9.1	5.5
	Wed	09/17/08	6:40 AM	4,553.5	10,286.3	12.5	12.4	NR	NR	NA	32	25	25	16	7	7	16	380	1,942.0	282,100	378	1602	1594	1117.9	7.2	10.7	4.7	9.1	6.0
	Thu	09/18/08	6:55 AM	4,566.5	10,299.1	13.0	12.8	NR	NR	NA	33	23	24	16	10	9	17	378	2,229.8	287,800	372	1603	1595	1125.0	7.1	11.7	6.6	9.7	5.4
	Fri	09/19/08	6:55 AM	4,579.1	10,311.4	12.6	12.3	NR	NR	NA	29	28	24	17	1	5	12	420	2,519.0	289,200	387	1605	1597	1139.3	14.3	1.7	3.8	2.1	4.8
	Sat	09/20/08	8:30 AM	4,591.6	10,324.5	12.5	13.1	NR	NR	NA	29	26	26	17	3	3	12	430	2,805.0	286,000	373	1606	1599	1149.9	10.6	3.7	0.1	4.7	0.0
	Sun	09/21/08	8:30 AM	4,604.6	10,336.7	13.0	12.2	NR	NR	NA	30	25	25	17	5	5	13	400	3,208.1	403,100	534	1607	1600	1157.0	7.1	6.9	4.1	6.7	4.0
112	Mon	09/22/08	6:55 AM	4,617.6	10,349.3	13.0	12.6	NR	NR	NA	30	24	27	17	6	3	13	392	127.7	NA	#VALUE!	1608	1062	1167.5	10.5	8.2	2.1	5.8	1.9
	Tue	09/23/08	6:55 AM	4,630.3	10,361.7	12.7	12.4	NR	NR	NA	29	26	25	16	3	4	13	402	429.1	301,400	400	1610	1604	1181.9	14.4	4.6	2.5	3.9	0.0
	Wed	09/24/08	6:55 AM	4,644.7	10,375.9	14.4	14.2	NR	NR	NA	29	27	23	16	2	6	13	407	764.7	335,600	391	1612	1606	1195.5	13.6	2.1	5.3	1.4	3.3
	Thu	09/25/08	7:00 AM	4,658.1	10,388.7	13.4	12.8	NR	NR	NA	28	28	25	17	0	3	11	442	1,077.9	313,200	399	1614	1609	1213.1	17.6	0.0	1.1	0.0	0.6
	Fri	09/26/08	6:55 AM	4,671.0	10,400.5	12.9	11.8	NR	NR	NA	4	12	10	10	-8	-6	-6	0	1,357.0	279,100	377	1615	1611	1223.7	10.6	5.1	3.1	6.5	6.0
	Sat	09/27/08	8:00 AM	4,682.0	10,413.0	11.0	12.5	NR	NR	NA	31	22	26	18	9	5	13	408	1,661.6	304,600	434	1617	1614	1241.0	17.3	5.2	1.6	7.0	1.8
	Sun	09/28/08	8:10 AM	4,696.4	10,426.9	14.4	13.9	NR	NR	NA	5	11	10	10	-6	-5	-5	0	1,984.0	322,400	380	1619	1616	1255.4	14.4	6.3	2.0	5.9	2.8
113	Mon	09/29/08	7:05 AM	4,711.6	10,442.1	15.2	15.2	NR	NR	NA	30	23	26	17	7	4	13	410	2,331.8	347,800	381	1621	1618	1270.0	14.6	4.6	0.5	4.3	0.0
	Tue	09/30/08	6:55 AM	4,724.7	10,455.6	13.1	13.5	NR	NR	NA	30	27	23	18	3	7	12	418	2,636.4	304,600	382	1623	1619	1280.9	5.4	0.2	0.5	0.0	5.4
	Wed	10/01/08	6:50 AM	4,738.5	10,469.0	13.8	13.4	NR	NR	NA	31	23	26	16	8	5	15	409	2,946.1	309,700	380	1624	1621	1291.5	10.6	5.4	1.4	4.5	0.7
	Thu	10/02/08	7:05 AM	4,751.5	10,482.6	13.0	13.6	NR	NR	NA	30	25	21	18	5	9	12	408	3,248.0	301,900	379	1626	1622	1302.4	10.9	2.4	6.7	4.2	5.2
	Fri	10/03/08	7:00 AM	4,766.8	10,497.8	15.3	15.2	NR	NR	NA	39	28	36	15	11	3	24	274	302.5	302,500	331	1629	1625	1326.2	23.8	2.7	0.0	2.8	0.0
	Sat	10/04/08	8:30 AM	4,785.2	10,516.4	18.4	18.6	NR	NR	NA	29	25	20	13	4	9	16	366	661.0	358,500	323	1632	1628	1344.9	18.7	1.9	6.8	0.2	4.3
	Sun	10/05/08	8:00 AM	4,804.0	10,535.2	18.8	18.8	NR	NR	NA	29	26	20	16	3	9	13	374	992.6	331,600	294	1634	1630	1358.8	13.9	1.3	7.6	0.0	3.8
114	Mon	10/06/08	7:00 AM	4,824.3	10,555.1	20.3	19.9	NR	NR	NA	31	20	22	16	11	9	15	355	1,341.6	349,000	289	1635	1632	1369.4	10.6	10.6	6.3	1.9	1.9
	Tue	10/07/08	NR	4,834.2	10,564.8	9.9	9.7	NR	NR	NA	39	18	17	16	21	22	23	173	1,520.2	178,600	304	1636	1633	1376.9	7.5	0.6	6.1	0.0	7.5
	Wed	10/08/08	6:50 AM	4,845.7	10,576.2	11.5	11.4	19.0	NR	NA	27	27	23	17	0	4	10	373	1,756.1	235,900	343	1637	1634	1384.4	7.5	0.8	4.1	0.5	4.9
	Thu	10/09/08	NR	4,862.4	10,592.7	16.7	16.5	29.0	NR	NA	29	23	21	16	6	8	13	373	2,088.2	332,100	333	1639	1637	1402.7	18.3	5.6	6.9	4.1	4.1
	Fri	10/10/08	NR	4,882.0	10,612.3	19.6	19.6	NR	NR	NA	28	18	14	15	10	14	13	239	2,438.6	350,400	298	1641	1639	1417.0	14.3	1.8	9.0	0.7	1.9
	Sat	10/11/08	NR	4,899.9	10,629.6	17.9	17.3	NR	NR	NA	31	23	24	16	8	7	15	381	2,811.2	372,600	353	1642	1641	1428.3	11.3	8.9	5.2	5.2	5.2
	Sun	10/12/08	NR	4,914.0	10,643.7	14.1	14.1	NR	NR	NA	32	23	22	NR	9	10	NA	370	3,131.1	319,900	378	1643	1642	1435.1	6.8	11.1	8.0	7.2	6.6
115	Mon	10/13/08	7:00 AM	4,929.9	10,659.4	15.9	15.7	NR	NR	NA	30	25	23	17	5	7	13	395	211.4	211,400	223	1645	1644	1449.5	14.4	5.0	6.9	4.9	4.9
	Tue	10/14/08	7:05 AM	4,952.3	10,681.3	22.4	21.9	NR	NR	NA	20	22	16	15	-2	4	5	252	530.1	318,700	240	1647	1646	1463.5	14.0	0.0	10.0	0.0	0.0
	Wed	10/15/08	7:00 AM	4,969.3	10,698.0	17.0	16.7	21.0	24.0		30	27	22	17	3	8	13	396	871.5	341,400	338	1648	1647	1470.7	7.2	3.9	7.9	2.2	3.2
	Thu	10/16/08	7:00 AM	4,984.9	10,713.5	15.6	15.5	25.0	33.0		32	27	20	15	5	12	17	369	1,201.4	329,900	354	1649	1648	1477.5	6.8	4.3	11.5	4.8	5.2
	Fri	10/17/08	6:55 AM	4,996.7	10,725.2	11.8	11.7	NR	NR	NA	31	30	20	16	1	11	15	398	1,440.8	239,400	340	1650	1649	1484.7	7.2	0.1	11.4	0.0	10.8
	Sat	10/18/08	6:45 AM	5,013.7	10,741.8	17.0	16.6	NR	NR	NA	32	29	22	17	3	10	15	389	1,799.8	359,000	356	1651	1650	1492.3	7.6	2.3	3.2	3.0	5.9
	Sun	10/19/08	8:00 AM	5,033.6	10,761.2	19.9	19.4	32.0	10.0	NA	35	21	28	17	14	7	18	365	2,210.5	410,700	348	1652	1652	1502.9	10.6	10.1	3.2	3.9	1.6
116	Mon	10/20/08	7:00 AM	5,052.3	10,780.4	18.7	19.2	NR	NR	NA	42	5	30	15	37	12	27	245	2,608.5	398,000	350	1654	1653	1513.9	11.0	0.0	8.4	0.0	2.0
	Tue	10/21/08	7:00 AM	5,070.2	10,798.1	17.9	17.7	4.0	NR	NA	35	24	26	16	11	9	19	359	3,005.1	396,600	371	1656	1655	1528.3	14.4	9.0	7.6	3.2	3.2
	Wed	10/22/08	7:00 AM	5,088.2	10,816.3	18.0	18.2	13.0	3.0		42	38	1	15	4	41	27	263	147.2	147,200	136	1660	1658	1553.3	25.0	1.0	0.0	0.0	0.0
	Thu	10/23/08	7:00 AM	5,105.6	10,833.3	17.4	17.0	14.0	13.0		35	27	29	16	8	6	19	360	518.9	371,700	360	1662	1661	1571.1	17.8	5.7	3.4	3.4	2.6
	Fri	10/24/08	6:50 AM	5,125.0	10,852.5	19.4	19.2	15.0	32.0		34	27	30	17	7	4	17	352	901.2	382,300	330	1665	1664	1593.0	21.9	5.7	2.8	0.9	0.0
	Sat	10/25/08	7:30 AM	5,145.8	10,873.4	20.8	20.9	NR	NR	NA	43	37	40	14	6	3	29	227	1,318.1	416,900	333	1668	1666	1611.9	18.9	3.8	0.0	0.6	0.0
	Sun	10/26/08	7:30 AM	5,168.0	10,895.7	22.2	22.3	NR	NR	NA	45	46	44	15	-1	1	30	85	1,773.2	455,100	341	1671	1669	1632.0	20.1	3.0	6.2	1.3	1.4
117	Mon	10/27/08	7:00 AM	5,189.1	10,916.5	21.1	20.8	15.0	NR	NA	27	22	23	20	5	4	7	180	2,071.9	298,700	238	1672	1671	1642.9	10.9	16.4	11.5	0.9	0.9
	Tue	10/28/08	6:50 AM	5,211.5	10,939.2	22.4	22.7	15.0	NR	NA	32	30	25	20	2	7	12	292	2,451.7	379,800	281	1675	1673	1660.6	17.7	0.4	10.2	0.0	0.0
	Wed	10/29/08	7:00 AM	5,227.6	10,955.5	16.1	16.3	15.0	NR	NA	36	32	32	18	4	4	18	332	2,766.4	314,700	324	1677	1675	1675.0	14.4	1.5	3.7	1.1	5.4
	Thu	10/30/08	7:00 AM	5,240.8	10,969.1	13.2	13.6	15.0	NR	NA	37	32	28	16	5	9	21	338	3,028.3	261,900	326	1679	1676	1686.0	11.0	2.7	8.6	4.4	7.9
	Fri	10/31/08	7:00 AM	5,253.5	10,981.3	12.7	12.2	15.0	NR	NA	37	29	34	16	8	3	21	352	3,272.5	244,200	327	1680	1678	1696.6	10.6	6.8	0.9	6.0	0.0
	Sat	11/01/08	7:30 AM	5,264.5	10,991.9	11.0	10.6	15.0	NR	NA	5	10	10	10	-5	-5	-5	0	202.4	202,400	312	1681	1679	1703.5	6.9	8.9	1.5	9.5	5.3
	Sun	11/02/08	8:00 AM	5,279.0	11,006.4	14.5	14.5	15.0	NR	NA	37	31	30	16	6	7	21	330	483.0	280,600	323	1683	1680	1714.4	10.9	5.3	7.0	6.4	7.1
118	Mon	11/03/08	7:30 AM	5,291.3	11,018.7	12.3	12.3	NR	NR	NA	35	33	33	16	2	2	19	350	716.9	233,900	317	1685	1682	1728.8	14.4	0.8	0.4	0.0	0.0
	Tue	11/04/08	6:55 AM	5,303.6	11,030.9	12.3	12.2	NR	NR	NA	37	30	32	17	7	5	20	333	964.6	247,700	337	1686	1683	1736.0	7.2	5.8	4.1	6.3	6.3
	Wed	11/05/08	6:55 AM	5,316.4	11,043.7	12.8	12.8	NR	NR	NA	36	32	34	17	4	2	19	341	1,211.0	246,400	321	1688	1685	1750.1	14.1	2.6	0.2	4.4	0.0
	Thu	11/06/08	6:50 AM	5,328.1	11,055.4	11.7	11.7	NR	NR	NA	27	29	32	16	-2	-5	11	343	1,431.3	220,300	314	1689	1686	1757.3	7.2	6.4	3.8	7.6	6.9
	Fri	11/07/08	8:00 AM	4,340.2	11,067.2	NA	11.8	NR	NR	NA	6	11	9	10	-5	-3	-4	0	1,659.1	227,800	#VALUE!	1691	1687	1767.9	10.6	4.7	7.8	7.0	7.0
	Sat	11/08/08	NR	NR	NR	NA	NA	NR	NR	NA	37	31	30	16	6	7	21	334	1,869.4	210,300	#VALUE!	1692	1689	17.0	-1750.9	5.2	7.1	6.2	7.4
	Sun	11/09/08	8:00 AM	5,361.6	11,088.8	NA	NA	NR	NR	NA	34	27	30	17	7	4	17	352	2,087.1	217,700	#VALUE!	1694	1690	1788.8	1771.8	4.4	6.6	7.9	8.0
119	Mon	11/10/08	7:00 AM	5,373.5	11,100.5	11.9	11.7	NR	NR	NA	36	32	30	16	4	6	20	350	2,389.9	302,800	428	1696	1692	1802.4	13.6	2.0	4.3	3.8	5.2
	Tue	11/11/08	8:15 AM	5,390.3	11,117.7	16.8	17.2	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	2,608.9	219,000	215	1699	1694	1819.9	17.5	0.0	0.0	0.0	0.0
	Wed	11/12/08	7:00 AM	5,405.4	11,132.3	15.1	14.6	NR	NR	NA	36	33	34	16	3	2	20	315	2,887.6	278,700	313	1701	1697	1839.0	19.1	5.1	2.4	4.7	1.7
	Thu	11/13/08	7:00 AM	5,419.8	11,146.7	14.4	14.4	NR	NR	NA	38	29	31	16	9	7	22	311	3,148.2	260,600	302	1702	1698	1845.2	6.2	8.0	6.2	6.3	5.7
	Fri	11/14/08	7:00 AM	5,434.2	11,160.7	14.4	14.0	NR	NR	NA	8	12	11	10	-4	-3	-2	0	135.8	135,800	159	1704	1700	1859.6	14.4	4.2	1.9	4.5	1.1
	Sat	11/15/08	7:00 AM	5,447.1	11,173.5	12.9	12.8	NR	NR	NA	37	31	30	16	6	7	21	315	377.3	241,500	313	1705	1701	1866.8	7.2	7.0	6.0	7.4	7.4
	Sun	11/16/08	8:00 AM	5,463.2	11,189.8	16.1	16.3	NR	NR	NA	6	11	9	0	-5	-3	6	0	683.0	305,700	315	1707	1703	1881.9	15.1	3.8	4.7	3.8	3.8

Table A-1. US EPA Arsenic Demonstration Project at Arnaudville, LA - Daily System Operation Log Sheet (Continued)

											Pressure Filtration											Backwash				Since Last BW			
Week No.	Day of Week	Date	Time	Tank A Hour Meter hrs	Tank B Hour Meter hrs	TA Run Time hrs	TB Run Time hrs	$KMnO_4$ Tank 1 Level[(a)] inches	$KMnO_4$ Tank 2 Level (Iron) inches	Estimated $KMnO_4$ Dosage µg/L as Mn	Influent psig	Outlet Tank A psig	Outlet Tank B psig	Effluent psig	Inlet-TA psig	Inlet-TB psig	Inlet-Effluent psig	Flow rate gpm	Totalizer to Distribution kgal	Gallon Usage gal	Daily Average Flowrate gpm	Tank A No.	Tank B No.	Total Volume kgal	Daily Volume kgal	Run Time Tank A hrs	Run Time Tank B hrs	Standby Time Tank A hrs	Standby Time Tank B hrs
120	Mon	11/17/08	7:00 AM	5,477.8	11,203.8	14.6	14.0	NR	NR	NA	36	31	33	17	5	3	19	334	947.6	264,600	309	1708	1705	1892.9	11.0	9.2	1.8	4.8	1.9
	Tue	11/18/08	7:30 AM	5,496.6	11,222.7	18.8	18.9	NR	NR	NA	46	45	44	0	1	2	46	70	1,298.3	350,700	310	1710	1707	1906.9	14.0	8.1	5.4	4.0	4.0
	Wed	11/19/08	7:15 AM	5,510.5	11,236.6	13.9	13.9	NR	NR	NA	7	11	10	10	-4	-3	-3	0	1,555.7	257,400	309	1712	1709	1921.6	14.7	3.4	4.6	5.5	5.5
	Thu	11/20/08	7:00 AM	5,523.8	11,250.0	13.3	13.4	NR	NR	NA	37	30	35	16	7	2	21	335	1,798.8	243,100	303	1713	1711	1932.3	10.7	7.0	0.8	5.7	0.0
	Fri	11/21/08	7:30 AM	5,537.7	11,264.3	13.9	14.3	NR	NR	NA	37	36	31	17	1	6	20	318	2,054.6	255,800	302	1715	1712	1943.2	10.9	0.5	6.4	0.0	6.4
	Sat	11/22/08	8:00 AM	5,550.4	11,276.8	12.7	12.5	NR	NR	NA	7	11	10	0	-4	-3	7	0	2,284.2	229,600	304	1716	1713	1950.0	6.8	NR	NR	3.9	7.4
	Sun	11/23/08	8:00 AM	5,564.9	11,291.0	14.5	14.2	NR	NR	NA	37	32	32	17	5	5	20	334	2,549.3	265,100	308	1717	1715	1960.6	10.6	NR	3.4	6.2	6.2
121	Mon	11/24/08	6:45 AM	5,579.1	11,305.2	14.2	14.2	NR	NR	NA	6	10	10	0	-4	-4	6	0	2,807.1	257,800	303	1718	1716	1967.8	7.2	9.7	9.0	5.8	5.8
	Tue	11/25/08	6:50 AM	5,593.6	11,319.7	14.5	14.5	NR	NR	NA	37	35	33	16	2	4	21	333	307.0	307,000	353	1720	1718	1982.2	14.4	0.9	3.4	0.8	4.7
	Wed	11/26/08	7:00 AM	5,607.0	11,333.0	13.4	13.3	NR	NR	NA	37	35	32	16	2	5	21	330	40.1	40,100	50	1721	1719	1989.4	7.2	3.3	7.4	4.5	5.3
	Thu	11/27/08	7:45 AM	5,623.7	11,349.3	16.7	16.3	NR	NR	NA	44	39	3	14	5	41	30	180	341.4	301,300	304	1723	1721	2003.7	14.3	2.7	0.0	2.4	0.0
	Fri	11/28/08	10:30 AM	5,640.7	11,366.3	17.0	17.0	NR	NR	NA	44	40	0	15	4	44	29	167	649.3	307,900	302	1725	1723	2018.1	14.4	3.3	0.0	1.6	0.0
	Sat	11/29/08	9:00 AM	5,655.1	11,380.3	14.4	14.0	NR	NR	NA	33	32	33	15	1	0	18	320	906.6	257,300	302	1726	1725	2028.7	10.6	7.4	4.1	5.1	4.2
	Sun	11/30/08	NR	5,668.7	11,394.0	13.6	13.7	NR	NR	NA	38	31	31	15	7	7	23	317	1,152.0	245,400	300	1727	1726	2035.9	7.2	9.9	9.0	6.8	6.8
122	Mon	12/01/08	7:30 AM	5,684.8	11,410.0	16.1	16.0	NR	NR	NA	7	11	10	10	-4	-3	-3	0	1,442.3	290,300	301	1729	1728	2049.9	14.0	3.6	5.5	3.4	3.4
	Tue	12/02/08	7:00 AM	5,699.3	11,424.5	14.5	14.5	NR	NR	NA	37	35	32	17	2	5	20	318	1,706.3	264,000	303	1731	1730	2064.2	14.3	1.7	3.2	2.0	1.9
	Wed	12/03/08	7:00 AM	5,713.5	11,438.8	14.2	14.3	NR	NR	NA	37	34	31	15	3	6	22	309	1,950.1	243,800	285	1733	1732	2078.6	14.4	3.7	6.1	0.0	0.0
	Thu	12/04/08	6:50 AM	5,727.0	11,452.2	13.5	13.4	NR	NR	NA	44	38	1	14	6	43	30	161	2,195.9	245,800	305	1734	1733	2085.4	6.8	6.1	0.0	5.4	0.0
	Fri	12/05/08	7:00 AM	5,741.3	11,466.0	14.3	13.8	NR	NR	NA	38	29	33	16	9	5	22	290	2,440.9	245,000	291	1735	1735	2096.4	11.0	9.7	4.6	7.9	5.3
	Sat	12/06/08	8:00 AM	5,755.9	11,480.9	14.6	14.9	NR	NR	NA	36	31	33	16	5	3	20	306	2,696.2	255,300	289	1737	1737	2110.8	14.4	6.6	1.5	6.1	0.3
	Sun	12/07/08	8:00 AM	5,769.6	11,496.0	13.7	15.1	NR	NR	NA	37	33	34	16	4	3	21	315	2,930.9	234,700	272	1738	1738	2118.0	7.2	8.5	4.5	6.6	6.7
123	Mon	12/08/08	6:55 AM	5,785.3	11,510.2	15.7	14.2	NR	NR	NA	37	30	30	16	7	7	21	288	3,196.1	265,200	296	1739	1739	2125.2	7.2	9.9	8.4	4.7	4.7
	Tue	12/09/08	7:05 AM	5,798.9	11,523.9	13.6	13.7	NR	NR	NA	37	33	31	15	4	6	22	297	151.1	151,100	184	1740	1740	2132.4	7.2	10.0	10.7	6.4	6.4
	Wed	12/10/08	7:00 AM	5,812.8	11,537.7	13.9	13.8	NR	NR	NA	44	38	1	14	6	43	30	139	392.1	241,000	290	1741	1741	2139.5	7.1	8.4	0.0	5.7	0.0
	Thu	12/11/08	7:00 AM	5,828.2	11,552.9	15.4	15.2	NR	NR	NA	38	33	36	16	5	2	22	310	640.8	248,700	271	1742	1743	2150.1	10.6	8.4	0.6	4.9	0.0
	Fri	12/12/08	NR	5,842.8	11,567.3	14.6	14.4	NR	NR	NA	39	31	34	17	8	5	22	280	890.0	249,200	286	1743	1744	2157.3	7.2	11.7	5.3	7.4	5.2
	Sat	12/13/08	NR	5,856.1	11,581.2	13.3	13.9	NR	NR	NA	38	32	35	15	6	3	23	320	1,095.0	205,000	251	1745	1745	2164.2	6.9	8.1	0.8	4.5	0.0
	Sun	12/14/08	NR	5,870.3	11,595.6	14.2	14.4	NR	NR	NA	37	32	32	15	5	5	22	298	1,343.2	248,200	289	1747	1747	2171.3	7.1	8.9	10.1	6.1	6.2
124	Mon	12/15/08	7:00 AM	5,886.7	11,611.3	16.4	15.7	NR	NR	NA	38	35	36	15	3	2	23	302	1,630.2	287,000	298	1747	1748	2186.4	15.1	5.2	2.0	4.6	2.8
	Tue	12/16/08	7:00 AM	5,901.7	11,626.2	15.0	14.9	NR	NR	NA	37	31	35	15	6	2	22	310	1,886.8	256,600	286	1749	1750	2200.1	13.7	6.3	1.6	3.6	0.9
	Wed	12/17/08	7:00 AM	5,914.1	11,639.8	12.4	13.6	NR	NR	NA	37	33	31	15	4	6	22	298	2,120.8	234,000	301	1751	1751	2211.0	10.9	5.3	7.8	5.3	5.3
	Thu	12/18/08	8:00 AM	5,929.4	11,655.0	15.3	15.2	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	2,390.1	269,300	294	1754	1754	2232.6	21.6	1.5	2.9	0.4	2.0
	Fri	12/19/08	8:00 AM	5,945.3	11,670.1	15.9	15.1	NR	NR	NA	7	12	11	10	-5	-4	-3	0	2,647.2	257,100	277	1756	1756	2247.0	14.4	2.8	5.6	1.6	4.8
	Sat	12/20/08	8:30 AM	5,958.5	11,683.4	13.2	13.3	NR	NR	NA	37	38	31	15	-1	6	22	295	2,869.1	221,900	279	1758	1758	2261.3	14.3	0.2	5.8	0.0	6.9
	Sun	12/21/08	9:00 AM	5,974.5	11,698.9	16.0	15.5	NR	NR	NA	37	37	35	16	0	2	21	296	3,131.9	262,800	278	1760	1761	2279.5	18.2	0.1	0.7	0.0	0.0
125	Mon	12/22/08	9:00 AM	5,990.1	11,714.5	15.6	15.6	NR	NR	NA	36	35	34	17	1	2	19	305	117.1	117,100	125	1762	1763	2293.1	13.6	1.2	1.6	0.0	0.0
	Tue	12/23/08	7:00 AM	6,002.8	11,727.2	12.7	12.7	NR	NR	NA	37	33	33	16	4	4	21	282	325.9	208,800	274	1763	1764	2300.3	7.2	5.5	5.0	4.5	4.3
	Wed	12/24/08	NR	6,018.5	11,743.2	15.7	16.0	NR	NR	NA	39	31	34	17	8	5	22	280	585.4	259,500	273	1766	1766	2336.2	35.9	11.0	5.9	7.9	5.0
	Thu	12/25/08	9:00 AM	6,035.6	11,759.8	17.1	16.6	NR	NR	NA	43	47	36	13	-4	7	30	148	871.7	286,300	283	1768	1769	2336.2	0.0	0.0	7.0	0.0	7.2
	Fri	12/26/08	NR	6,048.4	11,772.3	12.8	12.5	NR	NR	NA	5	12	10	10	-7	-5	-5	0	1,075.6	203,900	269	1770	1771	2350.2	14.0	3.7	3.0	5.5	5.5
	Sat	12/27/08	NR	6,066.5	11,790.2	18.1	17.9	NR	NR	NA	37	36	34	16	1	3	21	280	1,367.4	291,800	270	1773	1774	2371.4	21.2	2.0	2.7	0.6	0.6
	Sun	12/28/08	NR	6,078.4	11,802.6	11.9	12.4	NR	NR	NA	37	36	33	15	1	4	22	285	1,539.3	171,900	236	1775	1776	2385.4	14.0	0.6	1.0	0.7	0.7
126	Mon	12/29/08	7:00 AM	6,092.4	11,816.1	14.0	13.5	NR	NR	NA	40	33	34	16	7	6	24	268	1,764.7	225,400	273	1776	1777	2392.2	6.8	7.6	7.3	5.4	5.3
	Tue	12/30/08	7:00 AM	6,107.8	11,831.5	15.4	15.4	NR	NR	NA	39	33	34	15	6	5	24	278	2,012.8	248,100	269	1778	1779	2406.6	14.4	7.8	7.2	4.7	4.7
	Wed	12/31/08	7:00 AM	6,125.6	11,849.2	17.8	17.7	NR	NR	NA	38	37	35	15	1	3	23	293	2,304.9	292,100	274	1781	1782	2428.9	22.3	1.5	1.9	0.8	8.8
	Thu	01/01/09	12:00 PM	6,144.7	11,868.1	19.1	18.9	NR	NR	NA	39	34	33	16	5	6	23	284	2,621.0	316,100	277	1783	1784	2442.8	13.9	6.1	6.5	2.4	2.4
	Fri	01/02/09	7:00 AM	6,154.7	11,878.1	10.0	10.0	NR	NR	NA	39	37	36	15	2	3	24	292	2,794.1	173,100	289	1785	1786	2457.6	14.8	1.5	2.1	2.8	2.8
	Sat	01/03/09	7:30 AM	6,170.0	11,893.4	15.3	15.3	NR	NR	NA	39	35	34	15	4	5	24	285	3,048.0	253,900	276	1787	1788	2471.6	14.0	3.2	4.8	6.2	6.1
	Sun	01/04/09	8:00 AM	6,185.6	11,909.5	15.6	16.1	NR	NR	NA	38	39	34	15	-1	4	23	290	31.8	31,800	33	1790	1791	2493.5	21.9	0.2	2.5	0.0	3.8
127	Mon	01/05/09	7:00 AM	6,201.2	11,924.6	15.6	15.1	NR	NR	NA	39	36	35	272	3	4	-233	275	279.3	247,500	269	1791	1793	2504.5	11.0	8.1	4.2	4.7	4.2
	Tue	01/06/09	6:55 AM	6,216.7	11,939.7	15.5	15.1	NR	NR	NA	39	37	37	15	2	2	24	290	533.0	253,700	276	1794	1797	2528.8	24.3	1.8	0.7	1.5	0.0
	Wed	01/07/09	6:55 AM	6,230.7	11,953.2	14.0	13.5	NR	NR	NA	44	45	42	0	-1	2	44	147	769.2	236,200	286	1797	1801	2553.7	24.9	1.6	2.0	1.0	1.0
	Thu	01/08/09	7:00 AM	6,247.3	11,968.9	16.6	15.7	NR	NR	NA	38	34	35	15	4	3	23	283	1,041.5	272,300	281	1801	1808	2593.0	39.3	2.3	0.8	1.7	0.0
	Fri	01/09/09	7:00 AM	6,263.5	11,985.1	16.2	16.2	NR	NR	NA	39	37	34	15	2	5	24	289	1,312.9	271,400	279	1805	1812	2621.8	28.8	1.4	2.6	0.6	2.4
	Sat	01/10/09	8:00 AM	6,279.7	12,000.8	16.2	15.7	NR	NR	NA	39	35	37	15	4	2	24	288	1,578.2	265,300	277	1808	1816	2646.4	24.6	2.9	1.0	1.6	0.0
	Sun	01/11/09	7:30 AM	6,293.8	12,014.6	14.1	13.8	NR	NR	NA	44	1	41	14	43	3	30	164	1,808.1	229,900	275	1810	1819	2664.2	17.8	0.0	0.6	0.0	0.0
128	Mon	01/12/09	7:15 AM	6,310.4	12,031.4	16.6	16.8	NR	NR	NA	39	38	32	17	1	7	22	293	2,087.5	279,400	279	1814	1822	2684.5	20.3	0.9	3.5	0.0	3.8
	Tue	01/13/09	7:10 AM	6,325.4	12,045.9	15.0	14.5	NR	NR	NA	39	33	32	15	6	7	24	283	2,332.1	244,600	276	1816	1825	2706.9	22.4	5.1	5.6	4.0	4.0
	Wed	01/14/09	7:10 AM	6,341.1	12,061.7	15.7	15.8	NR	NR	NA	39	36	39	16	3	0	23	291	2,584.1	252,000	267	1819	1828	2728.0	21.1	1.4	2.4	1.1	1.1
	Thu	01/15/09	7:00 AM	6,356.6	12,076.7	15.5	15.0	NR	NR	NA	44	4	40	14	40	4	30	168	2,836.6	252,500	276	1821	1831	2745.9	17.9	0.0	0.1	0.0	0.7
	Fri	01/16/09	7:05 AM	6,375.1	12,095.6	18.5	18.9	NR	NR	NA	39	38	33	15	1	6	24	275	3,139.5	302,900	270	1825	1834	2771.5	25.6	1.1	4.0	0.0	1.0
	Sat	01/17/09	8:00 AM	6,391.4	12,111.5	16.3	15.9	NR	NR	NA	43	5	34	13	38	9	30	157	125.2	125,200	130	1827	1837	2789.2	17.7	0.0	3.6	0.0	4.5
	Sun	01/18/09	8:00 AM	6,409.6	12,129.3	18.2	17.8	NR	NR	NA	39	37	35	16	2	4	23	287	421.9	296,700	275	1831	1841	2818.0	28.8	1.7	2.4	0.0	0.0
129	Mon	01/19/09	6:50 AM	6,424.5	12,143.4	14.9	14.1	NR	NR	NA	44	3	41	14	41	3	30	167	654.0	232,100	267	1833	1844	2837.2	19.2	0.0	0.0	1.1	0.0
	Tue	01/20/09	6:55 AM	6,439.8	12,159.1	15.3	15.7	24.6	NR	NA	38	35	36	15	3	2	23	294	910.8	256,800	276	1837	1848	2864.1	26.9	2.2	0.9	0.0	0.0
	Wed	01/21/09	6:50 AM	6,456.2	12,174.9	16.4	15.8	31.5	NR		38	38	35	15	0	3	23	295	1,184.1	273,300	283	1842	1854	2904.2	40.1	0.2	0.6	0.0	0.0
	Thu	01/22/09	6:45 AM	6,473.7	12,191.1	17.5	16.2	NR	NR	NA	39	37	37	15	2	2	24	295	1,459.5	275,400	273	1846	1861	2944.2	40.0	1.0	0.0	0.0	0.0
	Fri	01/23/09	7:00 AM	6,492.1	12,207.9	18.4	16.8	NR	NR	NA	40	34	33	15	6	7	25	276	1,745.1	285,600	271	1849	1868	2979.4	35.2	3.1	1.3	3.4	0.0
	Sat	01/24/09	NR	6,510.2	12,225.3	18.1	17.4	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	2,045.6	300,500	282	1854	1875	3022.1	42.7	NR	NR	NR	NR
	Sun	01/25/09	NR	6,528.2	12,241.5	18.0	16.2	NR	NR	NA	39	38	32	15	1	7	24	285	2,327.9	282,300	276	1858	1883	3064.7	42.6	0.3	1.8	0.0	0.0
130	Mon	01/26/09	7:00 AM	6,545.2	12,258.1	17.0	16.6	NR	NR		39	38	33	15	1	6	24	277	2,582.2	254,300	252	1862	1888	3096.4	31.7	0.7	1.8	0.0	1.3
	Tue	01/27/09	7:30 AM	6,562.7	12,274.6	17.5	16.5	NR	NR		39	35	36	15	4	3	24	278	2,855.5	273,300	268	1866	1894	3131.6	35.2	2.0	0.9	0.9	0.0
	Wed	01/28/09	7:30 AM	6,579.4	12,290.1	16.7	15.5	NR	NR		39	34	37	15	5	2	24	288	3,122.0	266,500	276	1869	1900	3164.2	32.6	2.2	0.1	0.0	0.1
	Thu	01/29/09	7:30 AM	6,597.6	12,306.7	18.2	16.6	NR	NR		40	33	34	15	7	6	25	268	125.7	-2,996,300	-2,876	1874	1909	3214.9	50.7	2.2	0.9	1.4	0.0
	Fri	01/30/09	7:15 AM	6,615.5	12,323.3	17.9	16.6	NR	NR		40	32	38	15	8	2	25	0	312.7	187,000	181	1880	1918	3264.7	49.8	2.4	0.0	0.0	0.0
	Sat	01/31/09	7:30 AM	6,632.2	12,340.0	16.7	16.7	8.5	NR		44	4	36	15	40	8	29	0	322.3	9,600	10	1887	1926	43.0	-3221.7	0.0	0.0	1.2	1.1
	Sun	02/01/09	7:00 AM	6,645.0	12,352.6	12.8	12.6	19.5	NR		26	23	23	24	3	3	2	0	323.0	700	1	1891	1930	61.6	18.6	8.4	8.9	8.5	8.7

Table A-1. US EPA Arsenic Demonstration Project at Arnaudville, LA - Daily System Operation Log Sheet (Continued)

Week No.	Day of Week	Date	Time	Tank A Hour Meter hrs	Tank B Hour Meter hrs	TA Run Time hrs	TB Run Time hrs	$KMnO_4$ Tank 1 Level[(a)] inches	$KMnO_4$ Tank 2 Level (Iron) inches	Estimated $KMnO_4$ Dosage µg/L as Mn	Pressure Filtration: Influent psig	Outlet Tank A psig	Outlet Tank B psig	Effluent psig	Inlet-TA psig	Inlet-TB psig	Inlet-Effluent psig	Flow rate gpm	Totalizer to Distribution kgal	Gallon Usage gal	Daily Average Flowrate gpm	Backwash: Tank A No.	Tank B No.	Total Volume kgal	Daily Volume kgal	Since Last BW: Run Time Tank A hrs	Run Time Tank B hrs	Standby Time Tank A hrs	Standby Time Tank B hrs
131	Mon	02/02/09	6:50 AM	6,655.7	12,363.3	10.7	10.7	NR	NR		26	22	21	23	4	5	3	0	323.0	0	0	1891	1930	NR	#VALUE!	19.2	18.2	20.6	20.5
	Tue	02/03/09	7:00 AM	6,665.0	12,373.6	9.3	10.3	NR	NR		34	28	31	16	6	3	18	0	323.0	0	0	1895	1933	82.4	#VALUE!	4.5	1.6	5.5	3.4
	Wed	02/04/09	6:55 AM	6,675.9	12,384.9	10.9	11.3	NR	NR		33	30	30	16	3	3	17	373	536.6	213,600	321	1897	1934	88.5	6.1	2.1	3.7	1.7	5.1
	Thu	02/05/09	7:20 AM	6,687.1	12,396.1	11.2	11.2	NR	NR		34	28	30	16	6	4	18	368	775.0	238,400	355	1898	1935	92.3	3.8	6.3	4.4	7.7	7.1
	Fri	02/06/09	7:00 AM	6,699.4	12,408.6	12.3	12.5	NR	NR		35	27	27	16	8	8	19	345	1,027.5	252,500	339	1900	1936	98.4	6.1	4.5	7.7	6.8	8.5
	Sat	02/07/09	8:00 AM	6,711.5	12,420.8	12.1	12.2	NR	NR		33	28	31	16	5	2	17	375	1,274.8	247,300	339	1902	1938	106.9	8.5	4.4	1.1	7.4	1.2
	Sun	02/08/09	8:00 AM	6,723.5	12,433.0	12.0	12.2	NR	NR		30	25	25	15	5	5	15	372	1,523.2	248,400	342	1904	1939	113.8	6.9	4.8	4.4	6.7	6.7
132	Mon	02/09/09	7:30 AM	6,735.9	12,445.9	12.4	12.9	35.0	NR		28	28	16	NR	0	12	#VALUE!	346	1,778.1	254,900	336	1906	1940	120.3	6.5	5.1	7.7	5.9	6.4
	Tue	02/10/09	7:10 AM	6,746.5	12,456.7	10.6	10.8	NR	NR		33	30	30	16	3	3	17	364	2,011.4	233,300	363	1909	1942	131.0	10.7	0.8	2.9	0.6	5.7
	Wed	02/11/09	6:55 AM	6,757.9	12,468.0	11.4	11.3	NR	NR		35	28	32	16	7	3	19	359	2,245.6	234,200	344	1911	1944	139.1	8.1	3.7	1.2	6.2	2.5
	Thu	02/12/09	6:55 AM	6,769.8	12,480.0	11.9	12.0	NR	NR		33	30	29	16	3	4	17	343	2,488.0	242,400	338	1915	1946	157.4	18.3	1.1	2.8	1.0	5.0
	Fri	02/13/09	7:00 AM	6,781.5	12,492.2	11.7	12.2	NR	NR		41	39	1	15	2	40	26	263	2,732.4	244,400	341	1919	1948	163.7	6.3	0.3	0.0	0.0	0.0
	Sat	02/14/09	6:00 AM	6,791.1	12,501.9	9.6	9.7	NR	NR		9	9	9	NR	0	0	#VALUE!	NR	2,942.7	210,300	363	1922	1951	176.3	12.6	1.1	0.6	3.1	3.1
	Sun	02/15/09	NR	NR	NR	NA	NA	NR	NR		NR	NR	NR	NR	#VALUE!	#VALUE!	#VALUE!	NR	NR	#VALUE!	#VALUE!	NR	NR	NR	#VALUE!	NR	NR	NR	NR
133	Mon	02/16/09	6:50 AM	6,516.1	12,528.0	NA	NA	26.0	NR		7	10	10	10	-3	-3	-3	0	205.8	#VALUE!	#VALUE!	1931	1956	190.1	#VALUE!	0.7	3.0	0.3	5.6
	Tue	02/17/09	6:45 AM	6,827.9	12,528.0	NA	0.0	NR	NR		8	11	10	10	-3	-2	-2	0	436.7	230,900	#VALUE!	1935	1959	220.7	30.6	2.2	1.2	3.7	1.5
	Wed	02/18/09	6:50 AM	6,839.7	12,552.6	11.8	24.6	NR	NR		34	28	29	16	6	5	18	348	681.9	245,200	256	1939	1961	234.1	13.4	0.0	4.3	0.0	5.0
	Thu	02/19/09	6:50 AM	6,851.1	12,564.6	11.4	12.0	7.0	NR		33	31	29	17	2	4	16	340	922.9	241,000	344	1945	1964	253.2	19.1	0.3	2.6	0.0	3.4
	Fri	02/20/09	6:55 AM	6,861.9	12,575.9	10.8	11.3	16.0	NR		34	32	29	18	2	5	16	346	1,159.6	236,700	357	1949	1966	265.8	12.6	0.1	4.2	0.0	5.6
	Sat	02/21/09	7:15 AM	6,873.6	12,588.0	11.7	12.1	26.0	NR		7	10	10	10	-3	-3	-3	0	1,397.5	237,900	333	1952	1968	276.6	10.8	2.3	3.5	5.4	6.2
	Sun	02/22/09	7:30 AM	6,885.0	12,600.0	11.4	12.0	34.0	NR		34	29	31	17	5	3	17	352	1,637.3	239,800	342	1956	1970	289.6	13.0	1.2	2.0	3.6	5.2
134	Mon	02/23/09	6:48 AM	6,897.2	12,627.0	12.2	NA	NR	NR		33	29	31	17	4	2	16	360	1,887.3	250,000	#VALUE!	1960	1972	302.5	12.9	1.8	1.4	4.5	4.5
	Tue	02/24/09	6:50 AM	6,909.7	12,625.8	12.5	NA	NR	NR		6	10	10	10	-4	-4	-4	0	2,146.3	259,000	#VALUE!	1965	1974	317.1	14.6	0.8	1.0	2.4	2.4
	Wed	02/25/09	6:48 AM	NR	12,639.2	NA	13.4	NR	NR		33	30	31	16	3	2	17	259	2,410.2	263,900	#VALUE!	1970	1976	332.4	15.3	0.6	0.3	0.8	0.8
	Thu	02/26/09	6:45 AM	6,933.7	12,651.3	NA	12.1	NR	NR		44	42	42	NR	2	2	#VALUE!	137	2,649.8	239,600	#VALUE!	1974	1977	343.5	11.1	2.1	5.6	4.5	6.3
	Fri	02/27/09	6:55 AM	6,946.0	12,644.1	12.3	NA	0.0	NR		8	11	10	NR	-3	-2	#VALUE!	0	2,908.6	258,800	#VALUE!	1978	1979	356.5	13.0	0.8	3.1	0.1	5.2
	Sat	02/28/09	7:00 AM	6,958.1	12,676.5	12.1	NA	9.0	NR		34	29	31	16	5	3	18	363	3,155.1	246,500	#VALUE!	1981	1981	366.8	10.3	2.5	1.6	4.8	3.5
	Sun	03/01/09	7:00 AM	6,978.9	12,689.7	20.8	13.2	18.5	NR		34	28	31	17	6	3	17	362	139.5	-3,015,600	-3,112	1985	1983	379.1	12.3	1.8	1.4	4.2	4.2
135	Mon	03/02/09	6:50 AM	6,984.1	12,705.5	5.2	15.8	28.0	NR		34	28	30	17	6	4	17	340	414.1	274,600	585	1989	1985	391.7	12.6	1.7	2.1	4.2	4.2
	Tue	03/03/09	6:38 AM	6,997.2	12,717.3	13.1	11.8	36.0	NR		33	29	28	16	4	5	17	345	679.5	265,400	356	1993	1987	404.7	13.0	1.0	3.3	1.0	4.5
	Wed	03/04/09	6:52 AM	7,009.1	12,729.4	11.9	12.1	8.0	NR		33	29	30	17	4	3	16	363	920.1	240,600	334	1996	1989	415.4	10.7	1.0	2.0	2.1	2.1
	Thu	03/05/09	6:50 AM	7,021.5	12,742.3	12.4	12.9	16.0	NR		41	36	50	15	5	-9	26	255	1,170.9	250,800	331	1999	1990	426.1	10.7	1.0	0.0	0.9	0.0
	Fri	03/06/09	7:00 AM	7,033.9	12,755.3	12.4	13.0	26.0	NR		34	32	26	16	2	8	18	353	1,420.9	250,000	328	2002	1992	434.9	8.8	0.1	5.5	0.0	6.3
	Sat	03/07/09	8:00 AM	7,047.1	12,768.8	13.2	13.5	NR	NR		34	31	27	17	3	7	17	360	1,688.0	267,100	334	2005	1994	446.0	11.1	0.5	4.4	0.0	6.3
	Sun	03/08/09	8:00 AM	7,059.3	12,780.7	12.2	11.9	NR	NR		33	28	31	17	5	2	16	366	1,927.1	239,100	331	2007	1996	454.5	8.5	2.4	0.3	5.1	0.8
136	Mon	03/09/09	7:15 AM	7,083.3	12,794.8	24.0	14.1	NR	NR		27	22	18	13	5	9	14	357	2,203.6	276,500	259	2009	1997	460.6	6.1	5.1	5.8	5.1	5.1
	Tue	03/10/09	7:00 AM	7,087.2	12,809.2	3.9	14.4	NR	5.0		35	29	25	16	6	10	19	332	2,486.8	283,200	769	2013	1999	473.6	13.0	1.3	4.1	1.0	5.2
	Wed	03/11/09	6:55 AM	7,099.7	12,822.1	12.5	12.9	NR	12.0		33	30	27	16	3	6	17	346	2,743.4	256,600	337	2016	2001	484.3	10.7	1.0	4.2	0.8	5.6
	Thu	03/12/09	7:00 AM	7,112.7	12,835.0	13.0	12.9	NR	20.0		34	28	30	16	6	4	18	350	3,005.9	262,500	338	2019	2003	495.0	10.7	1.8	2.0	2.3	2.5
	Fri	03/13/09	7:00 AM	7,124.4	12,847.5	11.7	12.5	NR	27.0		35	29	26	16	6	9	19	322	3,244.3	238,400	329	2022	2004	503.7	8.7	1.6	7.0	2.3	5.9
	Sat	03/14/09	8:30 AM	7,136.0	12,859.5	11.6	12.0	NR	32.0		34	28	30	15	6	4	19	337	202.3	-3,042,000	-4,298	2025	2006	514.1	10.4	2.7	4.9	6.2	6.2
	Sun	03/15/09	NR	7,150.0	12,874.2	14.0	14.7	NR	NR		34	29	32	15	5	2	19	365	480.8	278,500	324	2029	2008	527.1	13.0	2.2	1.8	0.6	0.6
137	Mon	03/16/09	7:00 AM	7,161.0	12,885.6	11.0	11.4	NR	36.0		42	51	38	15	-9	4	27	191	703.7	222,900	332	2031	2009	535.8	8.7	0.0	1.8	0.0	2.3
	Tue	03/17/09	7:00 AM	7,174.0	12,898.8	13.0	13.2	NR	36.0		36	26	30	15	10	6	21	330	953.5	249,800	318	2034	2010	542.3	6.5	3.8	5.3	5.8	5.8
	Wed	03/18/09	6:50 AM	7,188.6	12,913.3	14.6	14.5	NR	NR		36	30	26	15	6	10	21	337	1,232.8	279,300	320	2037	2011	551.2	8.9	2.6	4.0	10.2	5.7
	Thu	03/19/09	6:50 AM	7,202.6	12,927.6	14.0	14.3	NR	0.0		34	33	29	15	1	5	19	345	1,512.9	280,100	330	2041	2013	564.2	13.0	0.1	5.0	0.0	5.2
	Fri	03/20/09	7:00 AM	7,216.0	12,941.7	13.4	14.1	NR	NR		34	32	30	15	2	4	19	343	1,776.2	263,300	319	2045	2015	576.9	12.7	0.4	0.0	4.0	4.7
	Sat	03/21/09	9:00 AM	7,230.6	12,957.5	14.6	15.8	NR	NR		35	33	27	15	2	8	20	337	2,076.9	300,700	330	2050	2017	592.1	15.2	0.0	5.7	0.0	5.3
	Sun	03/22/09	9:00 AM	7,243.9	12,970.6	13.3	13.1	NR	NR		35	28	32	15	7	3	20	341	2,338.6	261,700	330	2053	2020	604.3	12.2	2.6	1.3	0.8	0.1
138	Mon	03/23/09	6:45 AM	7,256.6	12,983.9	12.7	13.3	NR	13.0		34	33	28	15	1	6	19	350	2,595.7	257,100	330	2058	2022	619.5	15.2	0.2	3.5	0.0	2.7
	Tue	03/24/09	7:00 AM	7,269.6	12,997.3	13.0	13.4	NR	17.0		44	44	43	15	0	1	29	156	2,862.2	266,500	337	2063	2025	635.5	16.0	0.0	1.9	0.0	2.4
	Wed	03/25/09	7:10 AM	7,282.4	13,010.4	12.8	13.1	NR	4.0		35	33	30	15	2	5	20	340	3,117.0	254,800	328	2067	2027	648.1	12.6	0.6	4.1	0.7	5.8
	Thu	03/26/09	7:10 AM	NR	NR	NA	NA	NR	NR		NR	NR	NR	NR	#VALUE!	#VALUE!	#VALUE!	NR	NR	#VALUE!	#VALUE!	NR	NR	NR	#VALUE!	NR	NR	NR	NR
	Fri	03/27/09	6:45 AM	7,294.0	13,022.3	NA	NA	NR	10.0		39	20	23	15	19	16	24	245	68.6	#VALUE!	#VALUE!	2070	2029	658.7	#VALUE!	2.6	4.0	5.1	5.1
	Sat	03/28/09	7:00 AM	7,313.0	13,041.5	19.0	19.2	NR	13.0		46	15	48	15	31	-2	31	362	238.7	170,100	148	2070	2029	658.7	0.0	21.5	6.0	23.3	6.0
	Sun	03/29/09	NR	7,327.2	13,055.8	14.2	14.3	NR	16.0		33	32	32	16	1	1	17	365	509.9	271,200	317	2071	2030	662.5	3.8	11.8	7.6	7.6	7.6
139	Mon	03/30/09	10:00 AM	7,327.7	13,056.3	0.5	0.5	NR	19.0		33	30	31	17	3	2	16	368	513.2	3,300	110	2071	2030	662.5	0.0	12.3	14.1	8.9	8.9
	Tue	03/31/09	7:00 AM	7,327.7	13,056.3	0.0	0.0	NR	22.0		38	23	26	15	15	12	23	306	513.7	500	#DIV/0!	2071	2030	662.5	0.0	12.3	14.1	8.9	8.9
	Wed	04/01/09	6:47 AM	7,339.4	13,068.1	11.7	11.8	NR	24.0		33	31	27	18	2	6	15	335	737.4	223,700	317	2073	2031	668.6	6.1	0.9	5.6	0.8	6.1
	Thu	04/02/09	7:00 AM	7,352.5	13,081.3	13.1	13.2	NR	25.0		34	28	29	16	6	5	18	340	987.7	250,300	317	2075	2033	677.3	8.7	3.5	4.7	5.7	5.7
	Fri	04/03/09	NR	7,365.4	13,094.4	12.9	13.1	NR	26.0		34	30	29	16	4	5	18	353	1,234.9	247,200	317	2078	2035	687.6	10.3	1.5	3.4	1.2	4.6
	Sat	04/04/09	NR	7,378.3	13,107.3	12.9	12.9	NR	28.0		33	31	31	17	2	2	16	370	1,482.3	247,400	320	2081	2037	697.8	10.2	0.0	0.9	0.0	0.0
	Sun	04/05/09	NR	7,391.4	13,120.1	13.1	12.8	NR	NR		34	31	28	16	3	6	18	355	1,745.1	262,800	338	2084	2039	706.0	8.2	6.9	3.1	1.0	4.8
140	Mon	04/06/09	5:59 AM	7,404.6	13,134.4	13.2	14.3	NR	NR		33	31	30	17	2	3	16	350	1,979.6	234,500	285	2086	2040	715.2	9.2	0.3	3.7	1.1	5.3
	Tue	04/07/09	6:55 AM	7,418.3	13,148.2	13.7	13.8	NR	29.0		33	31	29	19	2	4	14	342	2,241.1	261,500	317	2089	2042	725.5	10.3	0.8	4.1	0.0	6.0
	Wed	04/08/09	7:00 AM	7,430.9	13,161.3	12.6	13.1	NR	30.0		7	10	10	10	-3	-3	-3	0	2,482.5	241,400	313	2092	2044	736.4	10.9	1.3	3.3	1.8	5.3
	Thu	04/09/09	7:00 AM	7,443.6	13,174.7	12.7	13.4	NR	30.0		34	31	30	17	3	4	17	334	2,730.4	247,900	317	2096	2046	749.3	12.9	0.5	2.7	0.0	5.1
	Fri	04/10/09	8:00 AM	7,456.6	13,188.7	13.0	14.0	NR	34.0		30	29	20	17	1	10	13	336	2,989.1	258,700	320	2102	2048	766.0	16.7	0.5	4.4	0.7	6.0
	Sat	04/11/09	8:00 AM	7,472.1	13,205.4	15.5	16.7	NR	33.0		30	30	30	18	0	0	12	344	17.9	-2,971,200	-3,080	2109	2051	788.0	22.0	0.7	2.4	0.7	3.4
	Sun	04/12/09	8:00 AM	7,488.2	13,222.2	16.1	16.8	NR	33.0		31	31	20	18	0	11	13	350	313.0	295,100	299	2115	2054	807.3	19.3	0.1	0.4	0.0	0.0
141	Mon	04/13/09	7:00 AM	7,500.2	13,234.9	12.0	12.7	NR	30.5		32	31	30	16	1	2	16	370	546.9	233,900	316	2120	2056	822.4	15.1	0.1	1.5	0.0	0.0
	Tue	04/14/09	7:00 AM	7,513.1	13,248.2	12.9	13.3	NR	30.5		48	50	49	0	-2	-1	48	0	800.3	253,400	322	2124	2058	835.3	12.9	0.8	4.0	0.0	5.4
	Wed	04/15/09	6:55 AM	7,524.3	13,260.3	11.2	12.1	NR	30.5		40	37	1	15	3	39	25	250	1,041.3	241,000	345	2128	2060	848.2	12.9	0.0	0.0	0.0	0.0
	Thu	04/16/09	6:50 AM	7,538.6	13,274.9	14.3	14.6	NR	30.5		34	30	29	17	4	5	17	346	1,319.3	278,000	321	2132	2063	863.4	15.2	1.2	3.4	2.2	4.8
	Fri	04/17/09	7:00 AM	7,552.7	13,290.0	14.1	15.1	NR	31.0		28	26	25	14	2	3	14	395	1,577.8	258,500	295	2137	2066	880.0	16.6	1.0	1.9	0.0	1.0
	Sat	04/18/09	8:00 AM	7,566.6	13,304.2	13.9	14.2	NR	31.0		33	26	31	16	7	2	17	336	1,849.6	271,800	322	2141	2069	894.8	14.8	3.0	0.2	2.8	0.0
	Sun	04/19/09	8:00 AM	7,577.8	13,315.8	11.2	11.6	NR	31.0		33	29	30	17	4	3	16	345	2,085.1	235,500	344	2149	2071	909.3	14.5	0.5	1.5	1.1	3.1

Table A-1. US EPA Arsenic Demonstration Project at Arnaudville, LA - Daily System Operation Log Sheet (Continued)

Week No.	Day of Week	Date	Time	Tank A Hour Meter	Tank B Hour Meter	TA Run Time	TB Run Time	$KMnO_4$ Tank 1 Level[(a)]	$KMnO_4$ Tank 2 Level (Iron)	Estimated $KMnO_4$ Dosage	Pressure Filtration: Influent	Outlet Tank A	Outlet Tank B	Effluent	Inlet-TA	Inlet-TB	Inlet-Effluent	Flow rate	Totalizer to Distribution	Gallon Usage	Daily Average Flowrate	Backwash: Tank A No.	Tank B No.	Total Volume	Daily Volume	Since Last BW: Run Time Tank A	Run Time Tank B	Standby Time Tank A	Standby Time Tank B
				hrs	hrs	hrs	hrs	inches	inches	µg/L as Mn	psig	psig	psig	psig	psig	psig	psig	gpm	kgal	gal	gpm	No.	No.	kgal	kgal	hrs	hrs	hrs	hrs
	Mon	04/20/09	7:00 AM	7,591.9	13,330.8	14.1	15.0	NR	31.5		33	31	30	17	2	3	16	339	2,361.5	276,400	317	2153	2074	931.2	21.9	0.5	0.9	0.0	0.0
	Tue	04/21/09	6:55 AM	7,603.9	13,343.1	12.0	12.3	NR	2.0		34	29	32	17	5	2	17	340	2,601.7	240,200	330	2157	2077	946.0	14.8	1.1	0.1	1.0	0.0
	Wed	04/22/09	7:30 AM	7,617.3	13,356.8	13.4	13.7	NR	NR		33	29	31	16	4	2	17	352	2,860.4	258,700	318	2161	2080	960.5	14.5	1.6	0.0	0.8	0.0
142	Thu	04/23/09	8:30 AM	7,630.2	13,370.0	12.9	13.2	NR	NR		32	30	29	17	2	3	15	361	3,113.3	252,900	323	2165	2083	974.8	14.3	1.2	1.5	0.9	0.9
	Fri	04/24/09	6:55 AM	7,642.3	13,382.6	12.1	12.6	NR	NR		32	30	29	15	2	3	17	346	80.4	-3,032,900	-4,095	2169	2086	989.4	14.6	0.9	1.4	1.4	0.7
	Sat	04/25/09	7:00 AM	7,654.1	13,394.8	11.8	12.2	NR	NR		34	28	27	15	6	7	19	342	323.3	242,900	337	2172	2088	999.6	10.2	2.7	4.9	4.8	5.4
	Sun	04/26/09	NR	7,666.9	13,408.0	12.8	13.2	NR	NR		43	42	41	NR	1	2	#VALUE!	188	587.7	264,400	339	2176	2091	1013.9	14.3	1.7	3.6	3.5	6.0
	Mon	04/27/09	7:00 AM	7,681.6	13,422.8	14.7	14.8	NR	2.0		33	30	27	15	3	6	18	345	892.4	304,700	344	2180	2094	1028.2	14.3	1.1	3.3	0.8	3.6
	Tue	04/28/09	7:00 AM	7,694.5	13,435.9	12.9	13.1	NR	NR		33	28	30	15	5	3	18	341	1,152.9	260,500	334	2183	2097	1040.6	12.4	2.7	2.3	5.1	5.0
	Wed	04/29/09	7:10 AM	7,706.9	13,448.4	12.4	12.5	NR	NR		32	31	30	17	1	2	15	351	1,399.2	246,300	330	2186	2099	1051.2	10.6	2.2	3.2	5.9	6.0
143	Thu	04/30/09	7:00 AM	7,719.4	13,461.0	12.5	12.6	NR	NR		34	29	31	16	5	3	18	342	1,643.1	243,900	324	2188	2101	1059.1	7.9	3.9	2.4	4.6	4.7
	Fri	05/01/09	7:00 AM	7,731.7	13,473.3	12.3	12.3	NR	9.0		32	33	30	16	-1	2	16	352	1,887.8	244,700	332	2191	2103	1069.6	10.5	0.3	1.8	0.0	3.0
	Sat	05/02/09	9:00 AM	7,746.2	13,488.0	14.5	14.7	NR	NR		33	31	28	17	2	5	16	348	2,177.4	289,600	331	2193	2105	1077.2	7.6	1.4	3.1	1.0	5.3
	Sun	05/03/09	9:30 AM	7,760.7	13,502.1	14.5	14.1	NR	NR		34	29	30	15	5	4	19	342	2,444.1	266,700	311	2195	2107	1085.8	8.6	5.3	3.6	7.4	6.7
	Mon	05/04/09	7:05 AM	7,773.1	13,514.4	12.4	12.3		NR		33	30	32	16	3	1	17	360	2,681.0	236,900	320	2197	2109	1093.7	7.9	4.1	0.1	4.6	0.0
	Tue	05/05/09	7:00 AM	7,784.5	13,525.8	11.4	11.4		NR		33	34	30	17	-1	3	16	343	2,914.5	233,500	341	2199	2110	1100.5	6.8	0.3	3.9	0.0	6.1
	Wed	05/06/09	6:50 AM	7,880.0	13,540.9	NA	15.1		NR		33	28	32	16	5	1	17	344	3,207.7	293,200	#VALUE!	2200	2112	1106.5	6.0	7.8	0.6	4.9	0.0
144	Thu	05/07/09	7:00 AM	7,818.1	13,559.1	NA	18.2		NR		33	30	29	15	3	4	18	342	264.8	-2,942,900	#VALUE!	2203	2114	1117.0	10.5	4.4	5.0	3.7	3.7
	Fri	05/08/09	7:00 AM	7,835.0	13,576.0	16.9	16.9		NR		32	33	31	16	-1	1	16	367	591.4	326,600	322	2206	2117	1129.1	12.1	0.0	0.6	0.0	0.0
	Sat	05/09/09	8:00 AM	7,852.7	13,593.5	17.7	17.5		NR		32	32	31	16	0	1	16	356	932.5	341,100	323	2208	2119	1137.8	8.7	6.3	1.8	0.6	0.5
	Sun	05/10/09	8:00 AM	7,869.3	13,609.9	16.6	16.4		NR		33	31	31	16	2	2	17	351	1,255.9	323,400	327	2210	2121	1146.4	8.6	3.6	1.7	2.5	0.0
	Mon	05/11/09	7:00 AM	7,884.1	13,625.0	14.8	15.1		NR		32	29	32	16	3	0	16	340	1,541.5	285,600	318	2212	2122	1152.4	6.0	4.0	0.0	3.5	0.0
	Tue	05/12/09	7:00 AM	7,897.7	13,638.4	13.6	13.4		8.0		32	33	30	18	-1	2	14	342	1,816.7	275,200	340	2215	2125	1164.1	11.7	0.0	1.8	0.0	2.3
	Wed	05/13/09	6:50 AM	7,911.8	13,652.0	14.1	13.6		18.0		34	29	33	16	5	1	18	340	2,084.3	267,600	322	2217	2128	1173.5	9.4	4.1	0.0	5.3	0.0
145	Thu	05/14/09	6:55 AM	7,924.7	13,665.2	12.9	13.2		28.0		6	12	11	10	-6	-5	-4	0	2,333.8	249,500	319	2220	2130	1184.4	10.9	2.4	2.6	5.5	5.5
	Fri	05/15/09	6:45 AM	7,937.4	13,677.9	12.7	12.7		36.0		33	34	29	16	-1	4	17	350	2,577.9	244,100	320	2223	2132	1194.6	10.2	0.6	5.4	0.6	5.4
	Sat	05/16/09	8:00 AM	7,950.4	13,690.9	13.0	13.0		30.0		33	6	13	11	27	20	22	330	2,827.5	249,600	320	2225	2135	1204.8	10.2	3.1	2.3	5.4	5.4
	Sun	05/17/09	8:00 AM	7,965.5	13,704.9	15.1	14.0		36.0		34	30	31	18	4	3	16	347	3,102.5	275,000	315	2228	2138	1217.2	12.4	3.2	1.5	4.4	2.7
	Mon	05/18/09	7:00 AM	7,978.2	13,718.3	12.7	13.4		28.0		33	28	32	16	5	1	17	330	85.9	-3,016,600	-3,855	2231	2141	1228.8	11.6	4.7	0.8	3.2	0.0
	Tue	05/19/09	7:00 AM	7,990.7	13,730.9	12.5	12.6		0.0		45	46	44	0	-1	1	45	71	332.6	246,700	328	2235	2143	1240.9	12.1	1.1	4.5	0.8	5.4
	Wed	05/20/09	7:00 AM	8,004.6	13,744.8	13.9	13.9		0.0		33	32	31	17	1	2	16	353	611.1	278,500	334	2238	2146	1253.6	12.7	0.3	0.6	0.0	0.0
146	Thu	05/21/09	7:00 AM	8,018.7	13,759.2	14.1	14.4		3.0		33	32	31	17	1	2	16	351	888.8	277,700	325	2242	2149	1268.3	14.7	0.0	1.0	0.0	0.0
	Fri	05/22/09	7:00 AM	8,032.2	13,773.0	13.5	13.8		6.0		7	11	9	10	-4	-2	-3	0	1,153.5	264,700	323	2245	2152	1280.7	12.4	2.6	1.5	4.9	3.1
	Sat	05/23/09	7:00 AM	8,045.2	13,786.3	13.0	13.3		8.0		34	32	29	16	2	5	18	349	1,409.2	255,700	324	2249	2155	1295.0	14.3	1.0	3.2	3.3	5.8
	Sun	05/24/09	7:15 AM	8,059.7	13,800.7	14.5	14.4		12.0		42	49	38	NR	-7	4	#VALUE!	186	1,691.3	282,100	325	2252	2159	1310.9	15.9	0.0	1.1	0.0	2.9
	Mon	05/25/09	10:00 AM	8,075.8	13,816.6	16.1	15.9		16.0		34	31	31	15	3	3	19	336	2,004.0	312,700	326	2256	2163	1325.1	14.2	2.4	2.0	1.6	1.5
	Tue	05/26/09	7:00 AM	8,087.9	13,828.5	12.1	11.9		19.0		32	33	30	18	-1	2	14	334	2,234.6	230,600	320	2259	2166	1337.5	12.4	0.7	1.1	1.0	1.0
	Wed	05/27/09	7:00 AM	8,099.9	13,840.0	12.0	11.5		22.0		32	33	32	16	-1	0	16	356	2,463.7	229,100	325	2262	2170	1351.8	14.3	0.5	0.2	0.8	0.8
147	Thu	05/28/09	7:00 AM	8,114.2	13,854.2	14.3	14.2		27.0		30	30	27	17	0	3	13	340	2,736.5	272,800	319	2265	2173	1364.2	12.4	0.6	3.0	0.7	3.9
	Fri	05/29/09	7:00 AM	8,129.3	13,869.0	15.1	14.8		32.0		33	31	33	16	2	0	17	368	3,027.3	290,800	324	2268	2177	1380.4	16.2	2.2	0.0	2.5	0.0
	Sat	05/30/09	NR	NR	NR	NA	NA		NR		NR	NR	NR	NR	#VALUE!	#VALUE!	#VALUE!	NR	NR	#VALUE!	#VALUE!	NR	NR	NR	#VALUE!	NR	NR	NR	NR
	Sun	05/31/09	NR	8,160.3	13,900.5	NA	NA		NR		NR	NR	NR	NR	#VALUE!	#VALUE!	#VALUE!	NR	352.7	#VALUE!	#VALUE!	2278	2188	1413.1	#VALUE!	0.0	0.0	0.0	0.1
	Mon	06/01/09	7:00 AM	8,177.3	13,917.5	17.0	17.0		NR		33	30	31	15	3	2	18	340	688.7	336,000	329	2280	2190	1422.9	9.8	5.6	2.0	2.7	2.6
	Tue	06/02/09	7:00 AM	8,193.3	13,933.3	16.0	15.8		NR		32	32	31	15	0	1	17	363	1,005.5	316,800	332	2283	2194	1435.3	12.4	0.6	0.1	0.0	0.0
	Wed	06/03/09	7:00 AM	8,207.3	13,947.1	14.0	13.8		NR		32	32	31	169	0	1	-137	343	1,283.3	277,800	333	2285	2196	1443.6	8.3	0.0	0.4	0.2	0.4
148	Thu	06/04/09	7:00 AM	8,201.1	13,960.7	NA	13.6		NR		32	33	30	15	-1	2	17	352	1,557.1	273,800	#VALUE!	2287	2198	1451.9	8.3	0.4	2.1	0.0	2.8
	Fri	06/05/09	7:00 AM	8,233.0	13,972.4	NA	11.7		NR		43	44	43	0	-1	0	43	160	1,801.7	244,600	#VALUE!	2288	2200	1458.3	6.4	5.8	3.5	6.2	6.2
	Sat	06/06/09	7:00 AM	8,247.9	13,987.1	14.9	14.7		NR		42	40	43	15	2	-1	27	350	2,096.7	295,000	332	2291	2203	1470.7	12.4	1.7	2.6	1.4	2.8
	Sun	06/07/09	9:00 AM	8,266.5	14,005.4	18.6	18.3		NR		32	30	30	15	2	2	17	343	2,452.9	356,200	322	2294	2207	1485.0	14.3	3.3	1.1	0.0	0.0
	Mon	06/08/09	7:00 AM	8,279.0	14,018.0	12.5	12.6		NR		43	3	36	14	40	7	29	198	2,709.0	256,100	340	2296	2209	14933.0	13448.0	0.0	3.1	0.0	5.1
	Tue	06/09/09	6:50 AM	8,294.2	14,033.5	15.2	15.5		NR		34	29	29	16	5	5	18	330	3,017.1	308,100	335	2299	2212	1505.7	-13427.3	4.7	4.2	4.6	4.7
	Wed	06/10/09	7:00 AM	8,310.4	14,049.8	16.2	16.3		NR		34	29	30	15	5	4	19	198	56.9	-2,960,200	-3,036	2302	2215	1518.1	12.4	3.9	2.8	4.5	3.2
149	Thu	06/11/09	7:00 AM	8,325.4	14,064.9	15.0	15.1		NR		32	32	31	16	0	1	16	350	357.2	300,300	333	2305	2218	1529.8	11.7	1.1	0.7	0.0	0.0
	Fri	06/12/09	7:00 AM	8,339.0	14,077.8	13.6	12.9		NR		20	24	22	23	-4	-2	-3	NR	430.3	73,100	92	2307	2223	1529.9	0.1	8.2	8.3	6.6	6.6
	Sat	06/13/09	7:30 AM	NR	NR	NA	NA		NR		NR	NR	NR	NR	#VALUE!	#VALUE!	#VALUE!	NR	NR	#VALUE!	#VALUE!	NR	NR	NR	#VALUE!	NR	NR	NR	NR
	Sun	06/14/09	NR	NR	NR	NA	NA		NR		NR	NR	NR	NR	#VALUE!	#VALUE!	#VALUE!	NR	NR	#VALUE!	#VALUE!	NR	NR	NR	#VALUE!	NR	NR	NR	NR
	Mon	06/15/09	7:00 AM	8,386.3	14,124.4	NA	NA		NR		34	30	29	16	4	5	18	335	993.1	#VALUE!	#VALUE!	2311	2228	1549.2	#VALUE!	9.2	7.7	2.7	2.7
	Tue	06/16/09	8:00 AM	8,403.5	14,141.8	17.2	17.4		NR		33	31	30	15	2	3	18	347	1,323.1	330,000	318	2314	2232	1563.4	14.2	3.8	1.3	3.4	0.6
	Wed	06/17/09	7:00 AM	8,418.0	14,157.5	14.5	15.7		NR		32	32	29	15	0	3	17	349	1,461.7	138,600	153	2322	2235	1567.6	4.2	2.9	2.6	4.9	5.0
150	Thu	06/18/09	7:30 AM	8,435.9	14,175.0	17.9	17.5		NR		34	27	32	15	7	2	19	330	1,796.0	334,300	315	2323	2237	1573.6	6.0	9.8	0.7	2.0	0.0
	Fri	06/19/09	7:30 AM	8,454.1	14,193.3	18.2	18.3		NR		33	32	32	16	1	1	17	331	2,136.7	340,700	311	2325	2239	1581.9	8.3	4.4	0.3	2.0	0.0
	Sat	06/20/09	7:30 AM	8,473.1	14,212.1	19.0	18.8		NR		34	26	33	15	8	1	19	315	2,486.9	350,200	309	2326	2241	1587.9	6.0	11.1	0.2	3.7	0.0
	Sun	06/21/09	7:30 AM	8,492.1	14,231.2	19.0	19.1		NR		33	30	32	16	3	1	17	331	2,832.8	345,900	303	2328	2243	1596.2	8.3	6.1	0.0	3.1	0.0
	Mon	06/22/09	7:00 AM	8,510.8	14,250.2	18.7	19.0		NR		34	36	25	16	-2	9	18	316	3,173.1	340,300	301	2330	2244	1602.6	6.4	0.5	9.4	0.0	2.3
	Tue	06/23/09	7:00 AM	8,527.1	14,266.1	16.3	15.9		NR		34	26	32	15	8	2	19	330	80.1	-3,093,000	-3,202	2330	2246	1606.3	3.7	10.3	6.0	5.1	5.0
	Wed	06/24/09	7:00 AM	8,545.8	14,235.1	18.7	NA		NR		34	28	31	16	6	3	18	329	439.8	359,700	#VALUE!	2332	2248	1614.8	8.5	7.6	3.2	2.9	3.0
151	Thu	06/25/09	7:00 AM	8,564.5	14,304.0	18.7	NA		NR		34	30	32	15	4	2	19	332	797.0	357,200	#VALUE!	2334	2250	1622.9	8.1	6.0	1.6	2.0	0.9
	Fri	06/26/09	7:00 AM	8,582.8	14,322.3	18.3	18.3		NR		32	31	31	15	1	1	17	330	1,143.2	346,200	315	2336	2252	1631.0	8.1	5.7	2.2	2.8	2.8
	Sat	06/27/09	8:00 AM	8,601.0	14,340.7	18.2	18.4		NR		33	30	30	15	3	3	18	330	1,489.9	346,700	316	2338	2254	1639.1	8.1	4.5	2.1	4.0	2.5
	Sun	06/28/09	7:15 AM	8,619.8	14,359.5	18.8	18.8		NR		35	28	29	15	7	6	20	320	1,845.3	355,400	315	2340	2256	1646.9	7.8	6.7	4.9	3.3	3.2
	Mon	06/29/09	NR	8,363.2	14,375.7	NA	16.2		NR		10	7	5	11	3	5	-1	0	2,000.7	155,400	#VALUE!	2342	2259	1650.9	4.0	8.2	8.0	5.5	5.5
	Tue	06/30/09	NR	NR	NR	NA	NA		NR		NR	NR	NR	NR	#VALUE!	#VALUE!	#VALUE!	NR	NR	#VALUE!	#VALUE!	NR	NR	NR	#VALUE!	NR	NR	NR	NR
	Wed	07/01/09	NR	8,656.3	14,398.4	NA	NA		NR		37	31	21	15	6	16	22	288	2,272.4	#VALUE!	#VALUE!	2372	2283	1656.7	#VALUE!	4.9	16.8	3.1	5.5
152	Thu	07/02/09	NR	8,679.1	14,422.3	22.8	23.9		NR		39	37	15	15	2	24	24	227	2,592.8	320,400	229	2376	2283	1665.5	8.8	2.2	40.8	0.0	5.5
	Fri	07/03/09	NR	NR	NR	NA	NA		NR		NR	NR	NR	NR	#VALUE!	#VALUE!	#VALUE!	NR	NR	#VALUE!	#VALUE!	NR	NR	NR	#VALUE!	NR	NR	NR	NR
	Sat	07/04/09	8:55 AM	8,720.2	14,464.4	NA	NA		NR		33	27	30	17	6	3	16	340	NR	#VALUE!	#VALUE!	2382	2285	1682.1	#VALUE!	5.4	2.0	4.1	0.0
	Sun	07/05/09	10:00 AM	8,740.5	14,486.0	20.3	21.6		NR		34	25	28	16	9	6	18	320	180.9	#VALUE!	#VALUE!	2384	2287	1690.6	8.5	8.0	5.4	3.6	3.7

Table A-1. US EPA Arsenic Demonstration Project at Arnaudville, LA - Daily System Operation Log Sheet (Continued)

											Pressure Filtration											Backwash				Since Last BW			
Week No.	Day of Week	Date	Time	Tank A Hour Meter hrs	Tank B Hour Meter hrs	TA Run Time hrs	TB Run Time hrs	$KMnO_4$ Tank 1 Level[(a)] inches	$KMnO_4$ Tank 2 Level (Iron) inches	Estimated $KMnO_4$ Dosage µg/L as Mn	Influent psig	Outlet Tank A psig	Outlet Tank B psig	Effluent psig	Inlet-TA psig	Inlet-TB psig	Inlet-Effluent psig	Flow rate gpm	Totalizer to Distribution kgal	Gallon Usage gal	Daily Average Flowrate gpm	Tank A No.	Tank B No.	Total Volume kgal	Daily Volume kgal	Run Time Tank A hrs	Run Time Tank B hrs	Standby Time Tank A hrs	Standby Time Tank B hrs
	Mon	07/06/09	8:00 AM	8,757.5	14,501.7	17.0	15.7		NR		34	26	28	15	8	6	19	321	507.5	326,600	333	2386	2289	1698.3	7.7	8.4	5.4	2.7	2.7
	Tue	07/07/09	7:00 AM	8,775.2	14,519.2	17.7	17.5		NR		32	32	27	15	0	5	17	342	848.3	340,800	323	2389	2292	1709.4	11.1	0.4	4.2	0.0	4.0
	Wed	07/08/09	7:00 AM	8,792.4	14,536.6	17.2	17.4		NR		33	34	27	15	-1	6	18	340	1,178.0	329,700	318	2391	2294	1717.9	8.5	0.4	5.2	0.0	3.5
153	Thu	07/09/09	7:00 AM	8,806.5	14,550.9	14.1	14.3		NR		41	37	31	15	4	10	26	196	1,386.3	208,300	244	2392	2295	1723.6	5.7	0.0	8.1	0.0	2.9
	Fri	07/10/09	7:00 AM	8,825.6	14,569.6	19.1	18.7		NR		34	32	29	16	2	5	18	349	1,744.2	357,900	316	2395	2298	1733.6	10.0	1.7	3.8	0.0	1.9
	Sat	07/11/09	9:30 AM	8,845.7	14,589.4	20.1	19.8		NR		43	49	38	14	-6	5	29	186	2,127.4	383,200	320	2397	2302	1745.7	12.1	0.0	0.6	0.0	0.0
	Sun	07/12/09	11:00 AM	8,867.2	14,611.2	21.5	21.8		NR		35	31	28	15	4	7	20	328	2,524.9	397,500	306	2400	2304	1754.8	9.1	3.6	6.1	0.0	0.8
	Mon	07/13/09	7:00 AM	8,883.9	14,627.9	16.7	16.7		NR		35	32	28	15	3	7	20	329	2,837.4	312,500	312	2402	2306	1762.6	7.8	2.6	7.5	1.3	1.4
	Tue	07/14/09	7:00 AM	8,900.3	14,649.5	16.4	21.6		NR		35	31	28	15	4	7	20	322	3,198.0	360,600	322	2405	2309	1768.3	5.7	5.5	7.2	0.5	0.5
	Wed	07/15/09	7:00 AM	8,917.8	14,667.0	17.5	17.5		NR		34	30	31	15	4	3	19	320	262.8	-2,935,200	-2,795	2407	2312	1777.7	9.4	6.4	1.3	3.5	0.5
154	Thu	07/16/09	7:00 AM	8,935.7	14,684.9	17.9	17.9		NR		34	32	28	15	2	6	19	310	592.2	329,400	307	2409	2314	1785.5	7.8	5.0	6.7	3.4	3.4
	Fri	07/17/09	7:00 AM	8,953.6	14,702.6	17.9	17.7		NR		33	34	32	15	-1	1	18	322	914.6	322,400	302	2411	2317	1795.4	9.9	2.2	0.9	1.6	0.6
	Sat	07/18/09	7:30 AM	8,970.6	14,719.2	17.0	16.6		NR		43	44	42	15	-1	1	28	119	1,219.5	304,900	303	2412	2319	1801.7	6.3	8.9	3.1	5.9	2.9
	Sun	07/19/09	7:30 AM	8,987.2	14,735.8	16.6	16.6		NR		42	44	41	15	-2	1	27	123	1,519.8	300,300	302	2414	2321	1809.8	8.1	4.4	5.3	5.6	5.5
	Mon	07/20/09	7:00 AM	9,004.1	14,753.2	16.9	17.4		NR		42	45	41	0	-3	1	42	108	1,819.2	299,400	291	2416	2324	1818.1	8.3	0.5	2.2	0.0	2.1
	Tue	07/21/09	7:00 AM	9,022.3	14,764.4	18.2	11.2		NR		34	30	31	15	4	3	19	311	2,133.2	314,000	377	2417	2328	1823.6	5.5	8.6	0.3	4.0	0.0
	Wed	07/22/09	7:00 AM	9,039.1	14,785.2	16.8	20.8		NR		42	40	39	0	2	3	42	108	2,421.7	288,500	259	2418	2332	1826.0	2.4	12.9	2.3	5.7	1.9
155	Thu	07/23/09	7:00 AM	9,056.0	14,802.1	16.9	16.9		NR		33	33	30	15	0	3	18	334	2,727.2	305,500	301	2420	2335	1835.2	9.2	3.0	1.9	1.8	0.4
	Fri	07/24/09	8:10 AM	9,075.0	14,818.2	19.0	16.1		NR		33	35	27	15	-2	6	18	330	3,049.7	322,500	308	2422	2336	1841.2	6.0	0.2	7.1	0.0	3.6
	Sat	07/25/09	NR	9,091.5	14,834.5	16.5	16.3		NR		33	32	28	16	1	5	17	315	3,380.1	330,400	336	2424	2538	1859.1	17.9	0.5	6.5	0.4	2.9
	Sun	07/26/09	7:00 AM	9,108.7	14,851.5	17.2	17.0		NR		33	33	27	15	0	6	18	320	386.9	-2,993,200	-2,917	2425	2340	1855.5	-3.6	2.0	7.7	0.6	4.6
	Mon	07/27/09	7:00 AM	9,121.0	14,863.0	12.3	11.5		NR		33	32	31	15	1	2	18	322	6,230.0	5,843,100	8,193	2426	2342	1861.9	6.4	4.7	2.3	6.1	4.2
	Tue	07/28/09	6:50 AM	9,132.3	14,874.8	11.3	11.8		NR		5	10	11	10	-5	-6	-5	0	837.0	-5,393,000	-7,786	2427	2343	1866.0	4.1	6.5	5.2	7.5	6.8
	Wed	07/29/09	6:55 AM	9,146.0	14,888.5	13.7	13.7		NR		33	34	30	16	-1	3	17	318	1,093.6	256,600	312	2429	2345	1874.3	8.3	0.9	3.6	0.8	4.7
156	Thu	07/30/09	7:00 AM	9,159.9	14,902.2	13.9	13.7		NR		6	11	10	10	-5	-4	-4	0	1,351.7	258,100	312	2430	2347	1880.7	6.4	5.7	1.5	6.0	2.8
	Fri	07/31/09	7:00 AM	9,173.7	14,916.2	13.8	14.0		NR		33	34	27	15	-1	6	18	323	1,606.0	254,300	305	2432	2348	1887.1	6.4	0.6	7.2	0.0	5.8
	Sat	08/01/09	8:00 AM	9,191.9	14,934.0	18.2	17.8		NR		33	32	32	15	1	1	18	320	1,939.6	333,600	309	2434	2351	1896.6	9.5	2.2	1.2	0.0	0.0
	Sun	08/02/09	9:00 AM	9,207.4	14,949.3	15.5	15.3		NR		41	34	1	13	7	40	28	185	2,221.4	281,800	305	2435	2352	1900.7	4.1	7.5	0.0	5.7	0.0
	Mon	08/03/09	7:10 AM	9,220.2	14,962.2	12.8	12.9	NR	NR	NA	7	12	11	10	-5	-4	-3	0	2,457.0	235,600	306	2437	2354	1909.0	8.3	2.9	4.3	4.0	4.0
	Tue	08/04/09	7:05 AM	9,234.8	14,976.5	14.6	14.3	NR	NR	NA	34	30	32	15	4	2	19	320	2,721.6	264,630	305	2438	2356	1914.7	5.7	9.3	2.2	5.3	2.1
	Wed	08/05/09	7:10 AM	9,253.2	14,995.1	18.4	18.6	NR	NR	NA	35	28	31	15	7	4	20	308	3,057.7	336,070	303	2440	2358	1922.6	7.9	9.0	4.0	4.1	3.5
157	Thu	08/06/09	7:05 AM	9,269.8	15,011.5	16.6	16.4	NR	NR	NA	35	29	33	15	6	2	20	328	87.0	87,000	88	2442	2361	1932.8	10.2	8.3	0.7	3.4	0.0
	Fri	08/07/09	7:05 AM	9,291.0	15,032.6	21.2	21.1	NR	NR	NA	33	33	31	15	0	2	18	324	436.6	349,600	275	2445	2364	1945.3	12.5	2.6	2.1	0.0	0.0
	Sat	08/08/09	NR	NR	NR	NA	NA	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	NR	NA	#VALUE!	NR	NR	NR	NA	NR	NR	NR	NR
	Sun	08/09/09	9:00 AM	9,328.8	15,069.9	NA	NA	NR	NR	NA	23	22	22	16	1	1	7	230	1,094.0	NA	#VALUE!	2450	2371	1968.8	NA	6.4	1.5	3.4	0.0
	Mon	08/10/09	7:25 AM	9,344.3	15,085.5	15.5	15.6	NR	NR	NA	34	32	31	16	2	3	18	305	1,381.8	287,800	308	2452	2373	1977.1	8.3	4.4	3.8	4.4	4.4
	Tue	08/11/09	7:00 AM	9,360.6	15,101.7	16.3	16.2	NR	NR	NA	33	33	32	15	0	1	18	325	1,666.6	284,800	292	2454	2376	1981.3	4.2	2.4	0.8	3.6	0.5
	Wed	08/12/09	10:55 AM	9,375.8	15,116.6	15.2	14.9	NR	NR	NA	34	32	32	15	2	2	19	322	1,943.7	277,100	307	2456	2379	1997.9	16.6	4.0	0.8	4.4	0.6
158	Thu	08/13/09	6:48 AM	9,393.7	15,134.2	17.9	17.6	NR	NR	NA	33	34	33	16	-1	0	17	326	2,263.2	319,500	300	2459	2283	2012.3	14.4	1.1	0.1	0.0	0.0
	Fri	08/14/09	7:00 AM	9,413.6	15,153.3	19.9	19.1	NR	NR	NA	34	28	32	15	6	2	19	320	2,605.8	342,600	293	2461	2387	2024.8	12.5	6.7	0.7	2.9	0.0
	Sat	08/15/09	7:30 AM	9,431.5	15,171.1	17.9	17.8	NR	NR	NA	32	33	31	15	-1	1	17	327	2,924.6	318,800	298	2465	2391	2041.3	16.5	0.8	1.3	0.6	0.6
	Sun	08/16/09	7:30 AM	9,448.0	15,187.4	16.5	16.3	NR	NR	NA	35	29	32	15	6	3	20	309	3,216.9	292,300	297	2466	2393	2047.1	5.8	8.2	2.4	4.9	1.0
	Mon	08/17/09	7:15 AM	9,465.2	15,204.6	17.2	17.2	NR	NR	NA	35	30	32	15	5	3	20	305	243.5	243,500	236	2468	2395	2055.1	8.0	7.4	3.1	3.4	2.5
	Tue	08/18/09	7:15 AM	9,479.9	15,219.9	14.7	15.3	NR	NR	NA	34	32	30	15	2	4	19	308	506.8	263,300	293	2470	2397	2064.2	9.1	4.6	3.8	5.0	5.0
	Wed	08/19/09	6:55 AM	9,497.7	15,234.2	17.8	14.3	NR	NR	NA	34	34	30	15	0	4	19	314	774.4	267,600	281	2472	2399	2072.5	8.3	2.0	3.5	6.0	4.6
159	Thu	08/20/09	7:00 AM	9,508.7	15,247.9	11.0	13.7	NR	NR	NA	35	30	29	15	5	6	20	298	1,023.1	248,700	340	2473	2401	2078.6	6.1	7.2	6.0	4.4	4.3
	Fri	08/21/09	7:00 AM	9,522.5	15,261.4	13.8	13.5	NR	NR	NA	34	33	33	15	1	1	19	323	1,269.6	246,500	301	2475	2404	2089.2	10.6	3.0	0.1	4.6	0.0
	Sat	08/22/09	7:30 AM	9,533.7	15,272.6	11.2	11.2	NR	NR	NA	34	33	31	15	1	3	19	300	1,482.8	213,200	317	2476	2405	2093.4	4.2	5.3	4.8	7.0	7.1
	Sun	08/23/09	10:00 AM	9,552.4	15,291.0	18.7	18.4	NR	NR	NA	35	30	33	15	5	2	20	298	1,798.2	315,400	283	2478	2408	2104.0	10.6	9.5	3.3	6.4	0.0
	Mon	08/24/09	7:00 AM	9,564.4	15,303.4	12.0	12.4	NR	NR	NA	36	36	29	15	0	7	21	304	2,017.0	218,800	299	2480	2409	2110.0	6.0	0.9	0.0	0.0	0.0
	Tue	08/25/09	7:00 AM	9,580.9	15,319.7	16.5	16.3	NR	NR	NA	34	35	33	15	-1	1	19	315	2,303.7	286,700	291	2482	2412	2120.7	10.7	0.8	1.3	0.0	0.0
	Wed	08/26/09	7:10 AM	9,602.5	15,341.1	21.6	21.4	NR	NR	NA	35	31	33	15	4	2	20	315	2,664.5	360,800	280	2484	2415	2130.5	9.8	5.9	1.5	1.6	0.4
160	Thu	08/27/09	7:15 AM	9,620.5	15,359.4	18.0	18.3	NR	NR	NA	36	30	29	15	6	7	21	294	2,979.6	315,100	289	2486	2417	2139.2	8.7	7.7	3.3	7.1	3.2
	Fri	08/28/09	7:15 AM	9,640.4	15,379.4	19.9	20.0	NR	NR	NA	41	39	1	15	2	40	26	193	47.9	47,900	40	2489	2420	2150.6	11.4	3.4	1.4	0.0	0.0
	Sat	08/29/09	NR	NR	NR	NA	NA	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	NR	NA	#VALUE!	NR	NR	NR	NA	NR	NR	NR	NR
	Sun	08/30/09	9:40 AM	9,677.8	15,416.5	NA	NA	NR	NR	NA	37	31	32	15	6	5	22	280	681.9	NA	#VALUE!	2493	2426	2172.2	NA	7.2	3.9	6.2	4.1
	Mon	08/31/09	7:15 AM	9,694.4	15,432.6	16.6	16.1	NR	NR	NA	37	31	36	15	6	1	22	280	958.3	276,400	282	2495	2429	2182.1	9.9	7.3	4.0	1.5	0.0
	Tue	09/01/09	7:00 AM	9,714.4	15,452.8	20.0	20.2	NR	NR	NA	35	35	33	15	0	2	20	310	1,296.0	337,700	280	2498	2432	2195.0	12.9	2.3	1.9	0.7	0.5
	Wed	09/02/09	7:00 AM	9,733.7	15,472.0	19.3	19.2	NR	NR	NA	35	32	33	15	3	2	20	312	1,611.3	315,300	273	2500	2435	2205.2	10.2	5.5	2.3	2.3	0.8
161	Thu	09/03/09	7:00 AM	9,752.6	15,491.1	18.9	19.1	NR	NR	NA	36	36	31	15	0	5	21	309	1,935.4	324,100	284	2503	2438	2217.8	12.6	0.7	4.0	0.0	0.8
	Fri	09/04/09	7:10 AM	9,769.4	15,507.8	16.8	16.7	NR	NR	NA	41	42	4	15	-1	37	26	189	2,214.9	279,500	278	2505	2441	2227.2	9.4	0.4	0.0	0.0	0.0
	Sat	09/05/09	7:30 AM	9,784.5	15,522.1	15.1	14.3	NR	NR	NA	37	31	36	15	6	1	22	305	2,470.0	255,100	289	2506	2445	2237.5	10.3	7.3	0.1	6.3	0.0
	Sun	09/06/09	7:20 AM	9,800.1	15,537.3	15.6	15.2	NR	NR	NA	35	31	34	15	4	1	20	307	2,736.4	266,400	288	2508	2448	2247.7	10.2	7.8	0.3	6.9	1.1
	Mon	09/07/09	7:30 AM	9,815.0	15,551.7	14.9	14.4	NR	NR	NA	36	30	34	15	6	2	21	293	2,991.9	255,500	291	2510	2451	2258.3	10.6	5.6	1.0	6.4	1.2
	Tue	09/08/09	6:55 AM	9,831.6	15,568.0	16.6	16.3	NR	NR	NA	37	31	31	15	6	6	22	287	3,276.2	284,300	288	2512	2454	2268.9	10.6	6.6	4.2	3.1	4.1
	Wed	09/09/09	7:00 AM	9,846.7	15,582.8	15.1	14.8	NR	NR	NA	36	33	30	15	3	6	21	286	259.5	259,500	289	2514	2457	2279.2	10.3	4.7	4.1	4.4	4.2
162	Thu	09/10/09	7:10 AM	9,861.3	15,597.0	14.6	14.2	NR	NR	NA	41	42	4	15	-1	37	26	194	509.1	249,600	289	2516	2460	2289.4	10.2	1.2	0.6	0.0	0.0
	Fri	09/11/09	7:10 AM	9,875.9	15,610.7	14.6	13.7	NR	NR	NA	36	30	36	15	6	0	21	294	754.5	245,400	289	2517	2464	2299.3	9.9	9.9	4.5	0.3	0.0
	Sat	09/12/09	8:00 AM	9,888.8	15,623.6	12.9	12.9	NR	NR	NA	44	44	41	15	0	3	29	200	983.3	228,800	296	2519	2466	2307.9	8.6	4.5	3.9	5.7	5.8
	Sun	09/13/09	8:00 AM	9,904.2	15,630.4	15.4	6.8	NR	NR	NA	35	35	32	15	0	3	20	295	1,245.4	262,100	463	2521	2470	2319.4	11.5	2.5	1.9	2.3	2.3
	Mon	09/14/09	7:05 AM	9,919.6	15,653.1	15.4	22.7	NR	NR	NA	43	21	37	14	22	6	29	168	1,469.9	224,500	204	2522	2473	2328.1	8.7	0.0	0.0	2.7	4.0
	Tue	09/15/09	7:15 AM	9,935.9	15,668.6	16.3	15.5	NR	NR	NA	37	32	33	15	5	4	22	283	1,768.4	298,500	313	2524	2477	2342.2	14.1	6.9	1.8	5.0	2.2
	Wed	09/16/09	7:15 AM	9,950.6	15,683.1	14.7	14.5	NR	NR	NA	36	35	30	15	1	6	21	303	2,027.0	258,600	295	2526	2480	2350.8	8.6	6.7	5.9	4.9	5.0
163	Thu	09/17/09	7:10 AM	9,965.3	15,697.0	14.7	13.9	NR	NR	NA	43	36	4	13	7	39	30	171	2,267.3	240,300	280	2527	2483	2359.1	8.3	9.4	4.5	0.0	0.0
	Fri	09/18/09	7:30 AM	9,980.0	15,711.2	14.7	14.2	NR	NR	NA	36	35	33	15	1	3	21	309	2,516.8	249,500	288	2529	2488	2373.5	14.4	4.1	1.3	3.3	0.6
	Sat	09/19/09	NR	NR	NR	NA	NA	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	NR	NA	#VALUE!	NR	NR	NR	NA	NR	NR	NR	NR
	Sun	09/20/09	NR	NR	NR	NA	NA	NR	NR	NA	NR	NR	NR	NR	NA	NA	NA	NR	NR	NA	#VALUE!	NR	NR	NR	NA	NR	NR	NR	NR

Table A-1. US EPA Arsenic Demonstration Project at Arnaudville, LA - Daily System Operation Log Sheet (Continued)

Week No.	Day of Week	Date	Time	Tank A Hour Meter (hrs)	Tank B Hour Meter (hrs)	TA Run Time (hrs)	TB Run Time (hrs)	$KMnO_4$ Tank 1 Level[a] (inches)	$KMnO_4$ Tank 2 Level (Iron) (inches)	Estimated $KMnO_4$ Dosage (µg/L as Mn)	Pressure Filtration: Influent (psig)	Outlet Tank A (psig)	Outlet Tank B (psig)	Effluent (psig)	Inlet-TA (psig)	Inlet-TB (psig)	Inlet-Effluent (psig)	Flow rate (gpm)	Totalizer to Distribution (kgal)	Gallon Usage (gal)	Daily Average Flowrate (gpm)	Backwash: Tank A No.	Tank B No.	Total Volume (kgal)	Daily Volume (kgal)	Since Last BW: Run Time Tank A (hrs)	Run Time Tank B (hrs)	Standby Time Tank A (hrs)	Standby Time Tank B (hrs)
	Mon	09/21/09	7:15 AM	10,021.8	15,751.6	NA	NA	NR	NR	NA	6	12	9	10	-6	-3	-4	0	3,029.7	NA	#VALUE!	2532	2495	2393.2	NA	2.1	7.8	4.6	6.9
	Tue	09/22/09	7:25 AM	10,036.0	15,765.3	14.2	13.7	NR	NR	NA	6	11	11	10	-5	-5	-4	0	7.2	7,200	9	2533	2498	2401.2	8.0	7.7	2.8	4.9	3.6
	Wed	09/23/09	7:15 AM	NR	NR	NA	NA	NR	NR	NA	37	36	36	16	1	1	21	324	266.1	258,900	#VALUE!	2535	2501	2411.8	10.6	6.7	0.8	5.2	0.0
164	Thu	09/24/09	7:00 AM	10,065.6	15,794.1	NA	NA	NR	NR	NA	39	33	32	15	6	7	24	291	523.8	257,700	#VALUE!	2536	2503	2417.9	6.1	9.4	3.5	5.1	4.6
	Fri	09/25/09	7:00 AM	10,081.0	15,808.8	15.4	14.7	NR	NR	NA	39	34	33	15	5	6	24	293	786.2	262,400	291	2538	2508	2431.5	13.6	6.4	1.9	4.2	2.5
	Sat	09/26/09	6:30 AM	10,100.6	15,826.2	19.6	17.4	NR	NR	NA	38	38	35	15	0	3	23	304	1,110.1	323,900	293	2541	2517	2456.1	24.6	1.9	0.9	1.1	0.0
	Sun	09/27/09	8:00 AM	10,120.9	15,845.5	20.3	19.3	NR	NR	NA	38	34	32	15	4	6	23	290	1,446.8	336,700	284	2543	2522	2470.5	14.4	6.0	4.2	3.2	3.3
	Mon	09/28/09	7:05 AM	10,141.4	15,865.9	20.5	20.4	NR	NR	NA	38	39	33	15	-1	5	23	299	1,788.0	341,200	278	2546	2526	2484.9	14.4	1.6	3.4	0.0	1.2
	Tue	09/29/09	7:00 AM	10,158.1	15,882.6	16.7	16.7	NR	NR	NA	38	39	37	15	-1	1	23	300	2,060.0	272,000	271	2548	2528	2494.8	9.9	1.1	1.5	0.0	0.0
	Wed	09/30/09	7:00 AM	10,175.3	15,899.4	17.2	16.8	NR	NR	NA	38	38	38	15	0	0	23	284	2,337.0	277,000	272	2550	2531	2502.8	8.0	2.2	1.1	0.8	0.0
165	Thu	10/01/09	8:00 AM	10,191.3	15,915.4	16.0	16.0	NR	NR	NA	38	39	39	15	-1	-1	23	295	2,597.7	260,700	272	2552	2533	2511.1	8.3	1.2	0.1	6.0	0.0
	Fri	10/02/09	8:00 AM	10,206.4	15,930.7	15.1	15.3	NR	NR	NA	38	38	38	15	0	0	23	295	2,846.4	248,700	273	2554	2535	2519.5	8.4	1.7	0.7	0.0	0.0
	Sat	10/03/09	8:00 AM	10,220.9	15,945.1	14.5	14.4	NR	NR	NA	38	38	38	15	0	0	23	295	3,090.9	244,500	282	2556	2537	2527.8	8.3	2.0	1.6	1.9	1.9
	Sun	10/04/09	8:00 AM	10,235.2	15,959.5	14.3	14.4	NR	NR	NA	38	38	37	15	0	1	23	293	47.6	47,600	55	2558	2539	2536.6	8.8	2.3	1.5	3.4	2.0
	Mon	10/05/09	7:15 AM	NR	NR	NA	NA	NR	NR	NA	39	34	34	15	5	5	24	280	283.5	235,900	#VALUE!	2559	2540	2540.7	4.1	11.1	10.7	6.0	6.1
	Tue	10/06/09	7:10 AM	10,263.3	15,987.7	NA	NA	NR	NR	NA	39	36	35	15	3	4	24	283	505.3	221,800	#VALUE!	2561	2542	2549.1	8.4	5.6	5.3	4.2	4.2
	Wed	10/07/09	7:15 AM	10,275.7	15,999.9	12.4	12.2	NR	NR	NA	44	4	39	15	40	5	29	117	719.6	214,300	290	2563	2545	2560.1	11.0	0.0	2.1	0.0	2.9
166	Thu	10/08/09	6:15 AM	10,288.7	16,013.2	13.0	13.3	NR	NR	NA	38	40	37	15	-2	1	23	287	940.6	221,000	280	2566	2549	2574.5	14.4	0.2	1.4	0.0	1.3
	Fri	10/09/09	7:00 AM	10,305.4	16,028.8	16.7	15.6	NR	NR	NA	38	39	36	15	-1	2	23	291	1,199.5	258,900	267	2568	2553	2586.6	12.1	1.3	1.7	0.0	0.0
	Sat	10/10/09	7:50 AM	10,320.7	16,043.3	15.3	14.5	NR	NR	NA	39	39	37	15	0	2	24	297	1,440.5	241,000	270	2570	2557	2598.7	12.1	2.0	0.9	3.3	1.1
	Sun	10/11/09	10:30 AM	10,338.5	16,061.0	17.8	17.7	NR	NR	NA	39	40	37	15	-1	2	24	289	1,733.5	293,000	275	2573	2561	2613.5	14.8	1.2	2.3	0.0	0.0
	Mon	10/12/09	6:50 AM	10,350.9	16,073.0	12.4	12.0	NR	NR	NR	38	38	36	15	0	2	23	281	1,931.2	197,700	270	2574	2563	2619.5	6.0	6.9	5.7	0.7	4.7
	Tue	10/13/09	7:00 AM	10,366.2	16,087.9	15.3	14.9	NR	NR	NR	44	45	45	15	-1	-1	29	91	2,182.8	251,600	278	2576	2566	2629.4	9.9	5.2	1.7	4.9	0.0
	Wed	10/14/09	7:15 AM	10,382.6	16,103.6	16.4	15.7	NR	NR	NR	39	36	39	15	3	0	24	288	2,443.7	260,900	271	2579	2572	2648.3	18.9	4.4	0.1	4.4	0.0
167	Thu	10/15/09	7:15 AM	10,402.2	16,122.8	19.6	19.2	NR	NR	NR	39	38	38	15	1	1	24	292	2,752.4	308,700	265	2582	2576	2662.7	14.4	3.6	0.7	0.0	0.0
	Fri	10/16/09	7:20 AM	10,422.3	16,143.1	20.1	20.3	NR	NR	NR	38	38	36	15	0	2	23	282	3,070.0	317,600	262	2585	2579	2675.3	12.6	2.0	2.8	1.5	2.7
	Sat	10/17/09	8:45 AM	10,440.7	16,161.0	18.4	17.9	NR	NR	NR	38	38	36	15	0	2	23	285	3,382.1	312,100	287	2588	2581	2686.1	10.8	6.7	5.9	1.0	4.3
	Sun	10/18/09	9:00 AM	10,458.0	16,178.4	17.3	17.4	NR	NR	NR	39	35	38	15	4	1	24	276	367.4	367,400	353	2590	2584	2696.1	10.0	3.9	2.3	2.4	0.0
	Mon	10/19/09	7:00 AM	10,469.6	16,190.9	11.6	12.5	NR	NR	NR	21	23	22	23	-2	-1	-2	0	396.6	29,200	40	2594	2586	2696.1	0.0	9.7	9.8	6.8	6.9
	Tue	10/20/09	7:10 AM	10,484.1	16,205.2	14.5	14.3	NR	NR	NR	38	35	34	16	3	4	22	295	633.8	237,200	275	2596	2588	2704.4	8.3	4.0	7.1	4.6	4.7
	Wed	10/21/09	7:15 AM	10,498.4	16,220.0	14.3	14.8	NR	NR	NR	44	5	41	12	39	3	32	128	877.7	243,900	279	2598	2590	2712.4	8.0	0.0	4.5	0.0	5.0
168	Thu	10/22/09	7:10 AM	10,513.2	16,234.4	14.8	14.4	NR	NR	NR	38	34	38	15	4	0	23	284	1,116.1	238,400	272	2600	2592	2721.1	8.7	6.7	0.8	5.2	0.0
	Fri	10/23/09	7:20 AM	10,529.5	16,250.9	16.3	16.5	NR	NR	NR	44	3	40	13	41	4	31	123	1,377.3	261,200	265	2602	2593	2727.2	6.1	0.0	7.9	0.0	6.0
	Sat	10/24/09	8:00 AM	10,547.5	16,269.4	18.0	18.5	NR	NR	NR	38	37	36	15	1	2	23	277	1,674.8	297,500	272	2605	2595	2737.8	10.6	2.9	2.1	7.3	4.7
	Sun	10/25/09	7:00 AM	10,565.5	16,287.9	18.0	18.5	NR	NR	NR	39	40	36	15	-1	3	24	298	1,966.9	292,100	267	2608	2597	2748.7	10.9	0.1	0.0	5.9	4.8
	Mon	10/26/09	8:00 AM	10,581.0	16,303.2	15.5	15.3	NR	NR	NR	38	38	38	15	0	0	23	302	2,208.1	241,200	261	2610	2599	2757.1	8.4	1.0	0.4	0.0	0.0
	Tue	10/27/09	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	#VALUE!	#VALUE!	#VALUE!	NR	NR	#VALUE!	#VALUE!	NR	NR	NR	#VALUE!	NR	NR	NR	NR
	Wed	10/28/09	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	#VALUE!	#VALUE!	#VALUE!	NR	NR	#VALUE!	#VALUE!	NR	NR	NR	#VALUE!	NR	NR	NR	NR
169	Thu	10/29/09	NR	NR	NR	NA	NA	NR	NR	NR	NR	NR	NR	NR	#VALUE!	#VALUE!	#VALUE!	NR	NR	#VALUE!	#VALUE!	NR	NR	NR	#VALUE!	NR	NR	NR	NR
	Fri	10/30/09	8:00 AM	10,623.2	16,345.1	NA	NA	NR	NR	NR	16	10	6	17	6	10	-1	NR	2,889.0	#VALUE!	#VALUE!	2618	2608	2770.4	#VALUE!	4.3	5.4	3.3	3.3
	Sat	10/31/09	7:00 AM	10,635.8	16,355.1	12.6	10.0	NR	NR	NR	33	31	25	16	2	8	17	366	3,084.9	195,900	293	2622	2622	2774.2	3.8	2.9	7.6	4.2	4.2
	Sun	11/01/09	8:00 AM	10,648.9	16,368.2	13.1	13.1	NR	NR	NR	33	28	25	15	5	8	18	348	75.0	75,000	95	2623	2623	2778.4	4.2	5.5	10.6	6.4	10.5
	Mon	11/02/09	7:00 AM	10,660.0	16,380.1	11.1	11.9	NR	NR	NR	35	27	27	15	8	8	20	326	325.4	250,400	363	2624	2624	2782.6	4.2	7.1	8.9	7.6	8.3
	Tue	11/03/09	8:00 AM	10,673.7	16,343.5	13.7	-36.6	NR	NR	NR	8	11	11	10	-3	-3	-2	0	606.5	281,100	107	2626	2626	2791.3	8.7	4.6	3.4	5.9	4.7
	Wed	11/04/09	7:00 AM	10,684.2	16,404.1	10.5	60.6	NR	NR	NR	8	11	11	10	-3	-3	-2	0	833.3	226,800	211	2628	2627	2797.7	6.4	0.8	5.6	0.1	5.8
170	Thu	11/05/09	7:20 AM	10,696.0	16,415.8	11.8	11.7	NR	NR	NR	8	11	10	10	0	-2	-2	0	1,107.8	274,500	389	2629	2628	2801.9	4.2	1.5	5.8	1.3	6.6
	Fri	11/06/09	7:30 AM	10,707.3	16,427.2	11.3	11.4	NR	NR	NR	8	11	10	10	-3	-2	-2	0	1,379.0	271,200	398	2630	2629	2806.1	4.2	1.9	9.0	2.1	7.9
	Sat	11/07/09	7:00 AM	10,717.7	16,437.7	10.4	10.5	NR	NR	NR	41	39	39	10	2	2	31	241	1,642.5	263,500	420	2631	2631	2811.8	5.7	4.4	2.7	6.4	3.0
	Sun	11/08/09	7:00 AM	10,727.7	16,447.9	10.0	10.2	NR	NR	NR	8	11	10	10	-3	-2	-2	0	1,894.2	251,700	415	2632	2632	2816.3	4.5	4.9	6.6	7.9	9.3
	Mon	11/09/09	7:00 AM	10,739.7	16,459.5	12.0	11.6	NR	NR	NR	28	21	22	15	7	6	13	409	2,184.2	290,000	410	2633	2634	2822.8	6.5	7.9	3.2	3.1	6.2
	Tue	11/10/09	7:00 AM	10,750.1	16,470.0	10.4	10.5	NR	NR	NR	29	22	21	15	7	8	14	393	2,446.4	262,200	418	2634	2635	2826.9	4.1	7.9	6.2	8.3	6.6
	Wed	11/11/09	9:30 AM	10,760.3	16,479.8	10.2	9.8	NR	NR	NR	29	21	22	15	8	7	14	410	2,716.2	269,800	450	2636	2637	2835.3	8.4	1.1	4.9	1.7	8.8
171	Thu	11/12/09	7:00 AM	10,769.0	16,488.2	8.7	8.4	NR	NR	NR	7	10	6	10	-3	1	-3	0	2,932.2	216,000	421	2637	2639	2841.4	6.1	1.9	2.5	5.8	6.4
	Fri	11/13/09	7:30 AM	10,774.5	16,498.0	5.5	9.8	NR	NR	NR	25	24	21	15	1	4	10	434	3,197.2	265,000	627	2639	2641	2850.1	8.7	0.8	3.5	0.0	4.2
	Sat	11/14/09	7:30 AM	10,788.4	16,507.0	13.9	9.0	NR	NR	NR	25	22	23	15	3	2	10	445	159.9	159,900	244	2640	2643	2856.2	6.1	3.6	1.1	6.9	2.0
	Sun	11/15/09	7:30 AM	10,800.3	16,519.1	11.9	12.1	NR	NR	NR	27	23	21	15	4	6	12	430	464.5	304,600	423	2642	2645	2864.2	8.0	3.1	3.9	6.1	7.2
	Mon	11/16/09	7:00 AM	10,811.5	16,529.6	11.2	10.5	NR	HR	NR	26	23	23	15	3	3	11	450	738.7	274,200	422	2644	2648	2874.4	10.2	2.3	0.5	3.8	0.6
	Tue	11/17/09	7:15 AM	10,828.7	16,546.9	17.2	17.3	NR	NR	NR	19	17	14	15	2	5	4	257	1,007.2	268,500	259	2645	2649	2878.6	4.2	4.4	8.4	3.0	3.0
	Wed	11/18/09	7:15 AM	10,846.8	16,564.9	18.1	18.0	NR	NR	NR	18	15	17	15	3	1	3	265	1,283.3	276,100	255	2646	2651	2884.7	6.1	8.0	1.0	3.1	0.0
172	Thu	11/19/09	7:15 AM	10,858.1	16,576.0	11.3	11.1	NR	NR	NR	8	10	9	11	-2	-1	-3	0	1,563.5	280,200	417	2648	2653	2893.0	8.3	5.5	3.4	3.7	5.1
	Fri	11/20/09	7:30 AM	10,868.6	16,587.0	10.5	11.0	NR	NR	NR	8	10	7	10	-2	1	-2	0	1,835.9	272,400	423	2650	2655	2901.4	8.4	3.4	2.6	5.8	4.5
	Sat	11/21/09	7:30 AM	10,879.0	16,599.8	10.4	12.8	NR	NR	NR	35	44	27	15	-9	8	20	318	2,097.4	261,500	380	2651	2657	2909.5	8.1	0.0	2.4	0.0	4.9
	Sun	11/22/09	7:45 AM	10,889.9	16,608.3	10.9	8.5	NR	NR	NR	8	9	7	10	-1	1	-2	0	2,359.2	261,800	457	2653	2659	2916.2	6.7	8.5	2.4	5.1	2.9
	Mon	11/23/09	7:00 AM	10,900.4	16,618.8	10.5	10.5	NR	NR	NR	7	9	6	10	-2	1	-3	0	2,631.2	272,000	432	2654	2661	2922.3	6.1	6.2	2.7	8.9	6.1
	Tue	11/24/09	7:30 AM	10,911.6	16,629.7	11.2	10.9	NR	NR	NR	26	24	21	15	2	5	11	432	2,906.6	275,400	415	2656	2663	2930.7	8.4	1.9	2.8	4.0	6.2
	Wed	11/25/09	7:30 AM	10,922.3	16,640.0	10.7	10.3	NR	NR	NR	26	22	22	15	4	4	11	423	3,169.5	262,900	417	2657	2665	2937.1	6.4	4.7	2.0	6.1	5.0
173	Thu	11/26/09	9:00 AM	10,933.1	16,644.7	10.8	4.7	NR	NR	NR	27	21	22	15	6	5	12	425	NR	#VALUE!	#VALUE!	2659	2667	2944.2	7.1	3.6	2.0	2.8	2.3
	Fri	11/27/09	9:00 AM	10,944.0	16,661.6	10.9	16.9	NR	NR	NR	27	22	23	15	5	4	12	430	441.6	441,600	555	2660	2669	2951.5	7.3	5.4	2.0	8.2	4.0
	Sat	11/28/09	11:30 AM	10,955.8	16,673.4	11.8	11.8	NR	NR	NR	26	22	22	15	4	4	11	426	736.2	294,600	416	2662	2671	2959.9	8.4	3.7	1.8	3.0	1.3
	Sun	11/29/09	9:00 AM	10,964.0	16,681.4	8.2	8.0	NR	NR	NR	27	22	21	15	5	6	12	411	952.1	215,900	444	2663	2672	2964.1	4.2	5.3	3.9	9.2	8.2
	Mon	11/30/09	6:25 AM	10,973.4	16,690.4	9.4	9.0	NR	NR	NR	27	21	22	15	6	5	12	427	1,185.2	233,100	422	2664	2674	2970.2	6.1	7.0	2.8	9.1	6.7
	Tue	12/01/09	7:00 AM	10,984.6	16,701.9	11.2	11.5	NR	NR	NR	26	25	22	18	1	4	8	430	1,476.1	290,900	427	2667	2677	2982.3	12.1	0.3	2.6	0.0	4.9
	Wed	12/02/09	7:00 AM	10,995.8	16,717.5	11.2	15.6	NR	NR	NR	26	22	23	16	4	3	10	440	1,740.7	264,600	338	2667	2679	2986.2	3.9	11.6	1.1	11.5	1.1
174	Thu	12/03/09	7:00 AM	11,007.6	16,724.7	11.8	7.2	NR	NR	NR	26	24	24	17	2	2	9	409	2,018.2	277,500	517	2669	2681	2994.6	8.4	4.4	2.5	6.5	5.2
	Fri	12/04/09	7:00 AM	11,011.1	16,735.6	3.5	10.9	NR	NR	NR	25	24	22	17	1	3	8	449	2,308.9	290,700	914	2672	2685	3009.0	14.4	0.3	0.0	1.2	0.5
	Sat	12/05/09	8:00 AM	11,033.7	16,749.5	22.6	13.9	NR	NR	NR	21	17	20	14	4	1	7	330	2,637.9	329,000	319	2679	2693	3039.7	30.7	0.0	0.0	1.0	0.0
	Sun	12/06/09	8:00 AM	11,050.9	16,766.5	17.2	17.0	NR	NR	NR	15	15	14	14	0	1	1	266	2,975.8	337,900	329	2682	2697	3054.2	14.5	4.9	5.0	3.3	5.0

Table A-1. US EPA Arsenic Demonstration Project at Arnaudville, LA - Daily System Operation Log Sheet (Continued)

Week No.	Day of Week	Date	Time	Tank A Hour Meter hrs	Tank B Hour Meter hrs	TA Run Time hrs	TB Run Time hrs	$KMnO_4$ Tank 1 Level[(a)] inches	$KMnO_4$ Tank 2 Level (Iron) inches	Estimated $KMnO_4$ Dosage µg/L as Mn	Pressure Filtration: Influent psig	Outlet Tank A psig	Outlet Tank B psig	Effluent psig	Inlet-TA psig	Inlet-TB psig	Inlet-Effluent psig	Flow rate gpm	Totalizer to Distribution kgal	Gallon Usage gal	Daily Average Flowrate gpm	Backwash: Tank A No.	Tank B No.	Total Volume kgal	Daily Volume kgal	Since Last BW: Run Time Tank A hrs	Run Time Tank B hrs	Standby Time Tank A hrs	Standby Time Tank B hrs
175	Mon	12/07/09	7:00 AM	11,068.8	16,784.8	17.9	18.3	NR	NR	NR	15	15	14	14	0	1	1	262	33.7	33,700	31	2685	2701	3068.6	14.4	3.9	3.1	0.3	0.0
	Tue	12/08/09	6:50 AM	11,081.8	16,797.3	13.0	12.5	NR	NR	NR	8	11	2	15	-3	6	-7	0	347.4	313,700	410	2687	2702	3074.6	6.0	6.7	6.6	0.0	0.0
	Wed	12/09/09	7:00 AM	11,093.0	16,808.4	11.2	11.1	NR	NR	NR	25	25	23	16	0	2	9	448	646.9	299,500	448	2689	2706	3086.8	12.2	0.0	0.0	0.6	0.0
	Thu	12/10/09	7:00 AM	11,106.2	16,820.9	13.2	12.5	NR	NR	NR	26	23	22	17	3	4	9	412	986.8	339,900	441	2691	2710	3098.6	11.8	3.6	0.0	2.1	3.0
	Fri	12/11/09	7:00 AM	11,118.9	16,833.0	12.7	12.1	NR	NR	NR	8	10	8	10	-2	0	-2	0	1,285.6	298,800	402	2694	2715	3114.5	15.9	1.8	0.9	1.9	0.3
	Sat	12/12/09	10:00 AM	11,131.1	16,844.9	12.2	11.9	NR	NR	NR	8	10	8	10	-2	0	-2	0	1,601.3	315,700	437	2696	2718	3124.8	10.3	3.4	4.1	1.9	1.6
	Sun	12/13/09	8:00 AM	11,142.3	16,855.5	11.2	10.6	NR	NR	NR	26	23	23	15	3	3	11	425	1,878.9	277,600	425	2698	2721	3135.0	10.2	2.1	2.4	1.1	0.7
176	Mon	12/14/09	7:00 AM	11,158.7	16,871.8	16.4	16.3	NR	NR	NR	8	9	6	10	-1	2	-2	0	2,180.8	301,900	308	2702	2726	3153.6	18.6	0.7	0.0	1.8	0.9
	Tue	12/15/09	7:00 AM	11,170.7	16,883.6	12.0	11.8	NR	NR	NR	27	22	22	15	5	5	12	424	2,478.2	297,400	417	2703	2728	3159.7	6.1	6.1	4.1	5.9	4.9
	Wed	12/16/09	7:00 AM	11,183.3	16,895.5	12.6	11.9	NR	NR	NR	42	41	40	0	1	2	42	187	2,802.3	324,100	441	2705	2731	3169.9	10.2	4.7	4.0	6.2	6.0
	Thu	12/17/09	7:00 AM	11,196.0	16,908.2	12.7	12.7	NR	NR	NR	8	10	8	10	-2	0	-2	0	3,116.7	314,400	413	2707	2734	3180.2	10.3	3.7	3.0	5.8	5.8
	Fri	12/18/09	7:00 AM	11,207.6	16,919.4	11.6	11.2	NR	NR	NR	8	10	8	10	-2	0	-2	0	133.1	133,100	195	2709	2737	3190.4	10.2	2.2	3.3	2.9	4.4
	Sat	12/19/09	8:00 AM	11,219.1	16,930.5	11.5	11.1	NR	NR	NR	25	23	22	16	2	3	9	428	419.3	286,200	422	2711	2740	3201.0	10.6	1.5	2.0	2.5	3.5
	Sun	12/20/09	10:00 AM	11,233.9	16,944.2	14.8	13.7	NR	NR	NR	26	23	22	16	3	4	10	423	770.6	351,300	411	2713	2743	3210.9	9.9	3.6	2.9	3.0	1.8
177	Mon	12/21/09	7:00 AM	11,242.7	16,953.8	8.8	9.6	NR	NR	NR	25	23	23	18	2	2	7	440	1,016.4	245,800	446	2715	2746	3221.5	10.6	1.7	0.2	2.0	0.0
	Tue	12/22/09	7:00 AM	11,254.1	16,965.2	11.4	11.4	NR	NR	NR	8	10	8	10	-2	0	-2	0	1,307.5	291,100	426	2717	2748	3230.7	9.2	1.1	3.5	1.2	5.9
	Wed	12/23/09	7:00 AM	11,266.5	16,976.8	12.4	11.6	NR	NR	NR	26	24	22	17	2	4	9	436	1,611.9	304,400	423	2719	2751	3240.5	9.8	1.7	2.7	2.5	4.6
	Thu	12/24/09	6:15 AM	11,279.1	16,988.7	12.6	11.9	NR	NR	NR	8	10	7	10	-2	1	-2	0	1,911.3	299,400	408	2721	2754	3250.7	10.2	0.6	3.5	1.2	5.5
	Fri	12/25/09	7:30 AM	11,291.9	17,001.5	12.8	12.8	NR	NR	NR	26	24	21	18	2	5	8	426	2,235.5	324,200	422	2723	2757	3261.0	10.3	0.5	4.0	0.8	5.9
	Sat	12/26/09	6:15 AM	11,306.3	17,015.9	14.4	14.4	NR	NR	NR	39	40	39	0	-1	0	39	190	2,530.1	294,600	341	2726	2761	3276.2	15.2	0.8	1.6	1.2	2.5
	Sun	12/27/09	6:15 AM	11,322.4	17,031.9	16.1	16.0	NR	NR	NR	8	8	6	10	0	2	-2	0	2,842.7	312,600	325	2728	2764	9.7	9.7	5.2	3.4	5.8	5.6
178	Mon	12/28/09	7:15 AM	11,335.0	17,044.5	12.6	12.6	NR	NR	NR	8	10	9	10	-2	-1	-2	0	3,175.6	332,900	440	2731	2768	24.5	14.8	1.4	1.2	1.7	1.4
	Tue	12/29/09	8:00 AM	11,352.2	17,061.7	17.2	17.2	NR	NR	NR	8	9	8	10	-1	0	-2	0	225.5	225,500	219	2733	2771	34.8	10.3	2.1	1.3	3.2	1.6
	Wed	12/30/09	7:00 AM	11,367.3	17,076.4	15.1	14.7	NR	NR	NR	26	23	22	15	3	4	11	435	554.0	328,500	368	2735	2774	45.0	10.2	3.1	1.8	4.5	2.6
	Thu	12/31/09	7:00 AM	11,378.4	17,087.4	11.1	11.0	NR	NR	NR	27	22	22	15	5	5	12	427	839.8	285,800	431	2737	2777	56.0	11.0	4.5	2.3	7.1	5.4
	Fri	01/01/10	NR	11,389.2	17,098.6	10.8	11.2	NR	NR	NR	26	25	22	18	1	4	8	430	1,120.4	280,600	425	2740	2780	67.5	11.5	0.3	2.7	6.6	4.5
	Sat	01/02/10	NR	11,400.3	17,109.9	11.1	11.3	NR	NR	NR	25	25	23	16	0	2	9	454	1,400.7	280,300	417	2742	2783	79.2	11.7	0.8	1.4	1.6	1.6
	Sun	01/03/10	NR	11,418.0	17,127.0	17.7	17.1	NR	NR	NR	25	24	21	14	1	4	11	430	1,735.0	334,300	320	2741	2786	88.3	9.1	3.2	1.5	4.9	2.9
179	Mon	01/04/10	9:00 AM	11,436.3	17,144.9	18.3	17.9	NR	NR	NR	26	23	22	17	3	4	9	448	2,070.1	335,100	309	2746	2788	97.4	9.1	5.2	5.0	5.1	5.1
	Tue	01/05/10	7:00 AM	11,451.3	17,159.4	15.0	14.5	NR	NR	NR	25	21	21	18	4	4	7	407	2,359.9	289,800	328	2748	2791	107.8	10.4	4.2	2.4	3.6	1.0
	Wed	01/06/10	7:00 AM	11,466.0	17,174.3	14.7	14.9	NR	NR	NR	16	15	14	15	1	2	1	256	2,686.3	326,400	368	2751	2794	120.0	12.2	2.3	2.3	1.6	1.6
	Thu	01/07/10	7:00 AM	11,478.6	17,186.4	12.6	12.1	NR	NR	NR	26	22	24	18	4	2	8	445	3,010.3	324,000	437	2753	2798	132.1	12.1	4.4	0.0	5.5	0.0
	Fri	01/08/10	6:50 AM	11,496.5	17,204.6	17.9	18.2	NR	NR	NR	16	16	14	18	0	2	-2	267	103.0	103,000	95	2756	2800	142.4	10.3	0.7	0.9	0.0	0.0
	Sat	01/09/10	8:00 AM	11,520.4	17,228.3	23.9	23.7	NR	NR	NR	17	16	16	15	1	1	2	509	152.2	49,200	34	2758	2803	288.6	146.2	5.2	0.0	0.0	0.0
	Sun	01/10/10	7:00 AM	11,526.1	17,236.5	5.7	8.2	NR	NR	NR	8	3	4	0	5	4	8	NA	NA	NA	NA	NA	NA	NA	NA	0.0	0.0	8.2	0.0
180	Mon	01/11/10	7:00 AM	11,540.4	17,250.5	14.3	14.0	NR	NR	NR	26	23	24	19	3	2	7	403	804.4	652,200	768	2760	2806	162.1	#VALUE!	4.6	0.4	1.5	0.0
	Tue	01/12/10	7:00 AM	11,559.9	17,279.7	19.5	29.2	NR	NR	NR	33	2	28	15	31	5	18	322	1,261.5	457,100	326	2763	2810	176.1	14.0	0.0	0.7	0.0	0.0
	Wed	01/13/10	7:00 AM	11,575.7	17,285.9	15.8	6.2	NR	NR	NR	26	22	22	16	4	4	10	408	1,647.7	386,200	723	2766	2813	188.7	12.6	2.6	1.8	2.0	1.2
	Thu	01/14/10	6:30 AM	11,590.0	17,300.2	14.3	14.3	NR	NR	NR	26	24	21	15	2	5	11	424	1,986.7	339,000	395	2768	2815	197.0	8.3	1.1	4.2	0.6	3.3
	Fri	01/15/10	7:00 AM	11,604.9	17,314.2	14.9	14.0	NR	NR	NR	26	20	23	16	6	3	10	399	2,327.8	341,100	394	2769	2818	205.0	8.0	8.1	0.1	3.7	0.0
	Sat	01/16/10	8:00 AM	11,619.9	17,329.4	15.0	15.2	NR	NR	NR	8	9	7	10	-1	1	-2	0	2,700.2	372,400	411	2772	2821	217.5	12.5	3.9	2.5	3.4	1.7
	Sun	01/17/10	8:00 AM	11,632.6	17,341.9	12.7	12.5	NR	NR	NR	35	27	2	15	8	33	20	304	3,014.5	314,300	416	2774	2824	228.1	10.6	5.1	3.7	4.6	0.5
181	Mon	01/18/10	NR	11,643.5	17,352.5	10.9	10.6	NR	NR	NR	8	9	8	10	-1	0	-2	0	6.9	6,900	11	2776	2827	238.3	10.2	4.4	2.9	4.7	3.1
	Tue	01/19/10	NR	11,655.6	17,364.3	12.1	11.8	NR	NR	NR	25	23	23	18	2	2	7	414	321.8	314,900	439	2779	2832	255.4	17.1	2.6	0.8	4.3	1.0
	Wed	01/20/10	NR	11,681.2	17,377.4	NA	13.1	NR	NR	NR	41	41	41	NR	0	0	NA	206	666.0	344,200	#VALUE!	2783	2837	286.3	30.9	3.0	0.6	3.1	0.0
	Thu	01/21/10	NR	11,689.5	17,388.8	NA	11.4	NR	NR	NR	8	10	8	10	-2	0	-2	0	939.4	273,400	#VALUE!	2784	2839	299.1	12.8	7.1	2.3	6.0	3.4
	Fri	01/22/10	NR	11,694.8	17,402.7	5.3	13.9	NR	NR	NR	8	10	9	10	-2	-1	-2	0	1,284.0	344,600	748	2786	2841	316.4	17.3	4.3	3.4	5.5	5.8
	Sat	01/23/10	8:00 AM	11,705.7	17,413.6	10.9	10.9	NR	NR	NR	26	24	22	16	2	4	10	410	1,576.2	292,200	447	2788	2844	339.8	23.4	1.4	4.0	1.2	3.3
	Sun	01/24/10	10:00 AM	11,720.6	17,427.0	14.9	13.4	NR	NR	NR	25	25	23	16	0	2	9	430	1,908.4	332,200	392	2790	2848	363.2	23.4	0.2	1.5	0.0	0.5
182	Mon	01/25/10	7:00 AM	11,733.2	17,438.4	12.6	11.4	NR	NR	NR	26	23	23	18	3	3	8	410	2,202.4	294,000	409	2792	2854	397.1	33.9	3.5	1.5	4.8	1.8
	Tue	01/26/10	7:00 AM	11,745.8	17,449.9	12.6	11.5	NR	NR	NR	25	24	23	18	1	2	7	409	2,510.8	308,400	427	2796	2861	444.1	47.0	0.0	1.1	0.0	0.9
	Wed	01/27/10	7:00 AM	11,758.8	17,461.7	13.0	11.8	NR	NR	NR	25	24	23	19	1	2	6	405	2,832.5	321,700	433	2801	2869	500.0	55.9	0.1	1.5	0.0	1.9
	Thu	01/28/10	8:30 AM	11,772.6	17,474.0	13.8	12.3	NR	NR	NR	25	23	23	18	2	2	7	422	3,162.2	329,700	422	2804	2876	542.9	42.9	3.1	2.6	4.3	3.7
	Fri	01/29/10	6:55 AM	11,785.3	17,484.7	12.7	10.7	NR	NR	NR	33	30	3	15	3	30	18	311	178.2	178,200	256	2808	2883	589.8	46.9	0.3	0.0	0.0	0.0
	Sat	01/30/10	7:33 AM	11,799.0	17,497.3	13.7	12.6	NR	NR	NR	33	44	28	15	-11	5	18	315	509.1	330,900	420	2811	2891	637.5	47.7	0.0	0.0	11.0	0.9
	Sun	01/31/10	8:00 AM	11,819.0	17,515.8	20.0	18.5	NR	NR	NR	32	4	27	15	28	5	17	232	863.9	354,800	308	2816	2900	696.8	59.3	0.0	0.1	0.0	0.0
183	Mon	02/01/10	7:00 AM	11,834.9	17,530.0	15.9	14.2	NR	NR	NR	25	23	23	18	2	2	7	413	1,248.1	384,200	427	2821	2909	757.5	60.7	2.3	1.1	1.7	0.6
	Tue	02/02/10	7:00 AM	11,848.5	17,542.6	13.6	12.6	NR	NR	NR	25	23	22	18	2	3	7	419	1,588.4	340,300	434	2825	2917	808.5	51.0	1.8	1.2	1.0	0.7
	Wed	02/03/10	7:00 AM	11,862.6	17,555.3	14.1	12.7	NR	NR	NR	26	23	23	18	3	3	8	429	1,936.8	348,400	435	2829	2925	859.6	51.1	2.9	1.2	3.1	0.6
	Thu	02/04/10	7:30 AM	11,877.1	17,568.6	14.5	13.3	NR	NR	NR	25	23	23	18	2	2	7	423	2,293.0	356,200	428	2833	2934	914.6	55.0	2.5	0.1	1.4	0.0
	Fri	02/05/10	7:00 AM	11,889.7	17,581.3	12.6	12.7	NR	NR	NR	25	24	22	18	1	3	7	210	2,598.3	305,300	402	2836	2837	940.4	25.8	0.3	2.0	0.0	1.9
	Sat	02/06/10	8:30 AM	11,903.6	17,594.9	13.9	13.6	NR	NR	NR	25	23	22	18	2	3	7	413	2,931.1	332,800	403	2838	2941	966.3	25.9	2.9	2.2	3.1	2.2
	Sun	02/07/10	8:30 AM	11,917.4	17,608.9	13.8	14.0	NR	NR	NR	25	23	23	18	2	2	7	419	3,272.1	341,000	409	2841	2946	1000.0	33.7	2.0	0.3	2.4	0.5
184	Mon	02/08/10	7:00 AM	11,933.7	17,624.3	16.3	15.4	NR	NR	NR	33	30	42	17	3	-9	16	396	330.0	330,000	347	2845	2951	1040.6	40.6	0.7	0.0	0.5	0.0
	Tue	02/09/10	7:00 AM	11,946.9	17,637.0	13.2	12.7	NR	NR	NR	24	22	22	16	2	2	8	432	652.6	322,600	415	2847	2956	1068.5	27.9	2.0	0.4	2.6	0.5
	Wed	02/10/10	7:00 AM	11,960.9	17,649.9	14.0	12.9	NR	NR	NR	25	22	22	17	3	3	8	422	973.4	320,800	398	2849	2959	1089.9	21.4	4.0	2.8	4.7	3.7
	Thu	02/11/10	6:55 AM	11,973.2	17,662.9	12.3	13.0	NR	NR	NR	8	10	10	11	-2	-2	-3	0	1,304.7	331,300	437	2852	2963	1119.3	29.4	0.5	2.4	0.0	1.9
	Fri	02/12/10	7:00 AM	11,986.1	17,675.0	12.9	12.1	NR	NR	NR	42	43	42	15	-1	0	27	420	1,607.5	302,800	404	2854	2966	1141.0	21.7	1.7	4.6	0.8	4.8
	Sat	02/13/10	8:00 AM	11,999.7	17,687.9	13.6	12.9	NR	NR	NR	8	10	10	15	-2	-2	-7	0	1,932.3	324,800	409	2856	2970	1166.6	25.6	4.6	2.3	5.0	2.0
	Sun	02/14/10	8:00 AM	12,013.2	17,701.1	13.5	13.2	NR	NR	NR	25	24	22	17	1	3	8	411	2,264.0	331,700	414	2859	2974	1196.0	29.4	0.3	1.3	0.0	0.7
185	Mon	02/15/10	10:48 AM	12,027.8	17,714.3	14.6	13.2	NR	NR	NR	8	10	10	11	-2	-2	-3	0	2,584.1	320,100	385	2861	2978	1221.5	25.5	2.5	0.3	3.0	0.1
	Tue	02/16/10	8:40 AM	12,046.8	17,728.8	19.0	14.5	NR	NR	NR	25	23	21	16	2	4	9	417	2,936.6	352,500	357	2864	2981	1246.8	25.3	0.6	3.8	0.5	4.1
	Wed	02/17/10	7:30 AM	12,055.3	17,741.7	8.5	12.9	NR	NR	NR	24	22	22	15	2	2	9	419	3,248.7	312,100	508	2866	2985	1272.3	25.5	2.6	1.1	2.4	1.3
	Thu	02/18/10	7:45 AM	12,068.7	17,755.3	13.4	13.6	NR	NR	NR	25	22	22	15	3	3	10	409	295.5	295,500	365	2868	2989	1297.7	25.4	4.4	0.8	5.0	2.1
	Fri	02/19/10	6:35 AM	12,082.6	17,768.8	13.9	13.5	NR	NR	NR	8	11	10	10	-3	-2	-2	0	625.2	329,700	401	2871	2993	1327.7	30.0	0.9	1.7	0.0	0.9
	Sat	02/20/10	9:00 AM	12,099.5	17,785.3	16.9	16.5	NR	NR	NR	34	27	3	15	7	31	19	282	959.3	334,100	333	2875	2998	1353.2	25.5	5.2	0.0	3.4	0.0
	Sun	02/21/10	8:30 AM	12,110.3	17,799.6	10.8	14.3	NR	NR	NR	27	23	21	16	4	6	11	384	1,258.3	299,000	405	2876	3000	1363.3	10.1	5.4	6.6	3.6	3.6

APPENDIX B

ANALYTICAL DATA TABLES

Table B-1. Analytical Results from Long-Term Sampling at Arnaudville, LA

Sampling Date		08/10/06			08/15/06				08/22/06				08/29/06				09/06/06		
Sampling Location / Parameter	Unit	IN	AC	TT	IN	AC	TA	TB	IN	AC	TA	TB	IN	AC	TA	TB	IN	AC	TT
Alkalinity (as $CaCO_3$)	mg/L	312	324	316	316	337	312	324	338	353	336	344	335	350	331	326	342	354	344
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ammonia (as N)	mg/L	1.9	1.7	1.3	-	-	-	-	-	-	-	-	-	-	-	-	2.2	2.0	1.1
Fluoride	mg/L	0.3	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1
Sulfate	mg/L	<1	<1	<1	-	-	-	-	-	-	-	-	-	-	-	-	<1	<1	<1
Nitrate (as N)	mg/L	<0.05	<0.05	0.1	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	<0.05	0.2
P (as P)	µg/L	683	740	196	663	658	186	185	652	766	224	207	592	815	199	189	650	721	200
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silica (as SiO_2)	mg/L	39.7	40.7	39.8	41.5	41.7	41.2	40.6	40.7	41.7	41.3	40.8	39.8	40.3	40.1	38.0	39.3	40.9	40.0
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	17.0	3.7	0.1	21.0	2.4	0.2	0.3	24.0	3.1	0.6	0.3	24.0	3.1	0.4	0.4	18.0	2.9	0.1
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOC	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH	S.U.	6.8	7.3	7.3	7.0	7.2	7.2	7.2	6.8	7.3	7.3	7.3	6.9	7.4	7.3	7.3	6.9	7.3	7.3
Temperature	°C	25.0	25.0	25.0	21.9	24.9	24.4	24.9	24.0	23.7	23.7	23.6	24.9	24.9	24.9	25.0	23.6	23.5	23.7
DO	mg/L	1.5	7.2	3.2	0.9	5.5	2.1	1.6	2.2	6.5	3.8	4.3	1.7	7.0	3.3	3.9	2.3	5.6	3.4
ORP	mV	-2.7	244	258	-6.7	457	436	424	6.1	255	242	303	5.4	306	317	314	46.2	227	247
Total Chlorine	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Hardness (as $CaCO_3$)	mg/L	264	252	251	-	-	-	-	-	-	-	-	-	-	-	-	264	263	258
Ca Hardness (as $CaCO_3$)	mg/L	170	163	162	-	-	-	-	-	-	-	-	-	-	-	-	170	172	167
Mg Hardness (as $CaCO_3$)	mg/L	93.6	88.7	89.0	-	-	-	-	-	-	-	-	-	-	-	-	94.1	90.8	90.9
As (total)	µg/L	38.2	38.8	11.8	28.8	28.8	8.7	9.5	36.3	38.3	11.1	10.7	30.8	36.3	10.7	10.4	28.5	30.2	10.5
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
As (soluble)	µg/L	32.4	10.7	10.5	-	-	-	-	-	-	-	-	-	-	-	-	28.5	10.2	10.7
As (particulate)	µg/L	5.9	28.1	1.3	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	20.0	<0.1
As (III)	µg/L	28.7	0.4	0.4	-	-	-	-	-	-	-	-	-	-	-	-	27.3	0.5	0.5
As (V)	µg/L	3.6	10.3	10.1	-	-	-	-	-	-	-	-	-	-	-	-	1.2	9.7	10.2
Fe (total)	µg/L	2,138	2,058	<25	2,304	1,890	<25	<25	1,851	1,938	<25	<25	2,059	2,602	<25	<25	2,088	1,950	<25
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fe (soluble)	µg/L	1,998	<25	<25	-	-	-	-	-	-	-	-	-	-	-	-	1,535	<25	<25
Mn (total)	µg/L	138	787	147	132	678	21	617[(a)]	131	600	73	1443[(a)]	148	932	358	202	142	750	384
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mn (soluble)	µg/L	141	229	147	-	-	-	-	-	-	-	-	-	-	-	-	148	424	394

(a) Samples re-run with similar results.

Table B-1. Analytical Results from Long-Term Sampling at Arnaudville, LA (Continued)

Sampling Date		09/12/06				09/19/06				09/26/06				10/03/06		
Sampling Location Parameter	Unit	IN	AC	TA	TB	IN	AC	TA	TB	IN	AC	TA	TB	IN	AC	TT
Alkalinity (as $CaCO_3$)	mg/L	342 -	356 -	354 -	342 -	333 -	342 -	328 -	338 -	334 -	357 -	348 -	330 -	333 -	348 -	319 -
Ammonia (as N)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	2.1	1.9	0.6
Fluoride	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	0.2	0.2	0.2
Sulfate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	<1	<1	<1
Nitrate (as N)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	<0.05	0.4
P (as P)	µg/L	611 -	692 -	171 -	186 -	570 -	666 -	199 -	201 -	493 -	585 -	206 -	196 -	596 -	700 -	265 -
Silica (as SiO_2)	mg/L	40.3 -	41.0 -	40.8 -	41.5 -	41.8 -	43.2 -	43.4 -	43.0 -	39.9 -	41.5 -	40.9 -	41.8 -	40.6 -	41.8 -	41.7 -
Turbidity	NTU	24.0 -	2.8 -	0.2 -	0.2 -	26.0 -	3.7 -	0.1 -	0.2 -	20.0 -	3.7 -	0.1 -	0.1 -	25.0 -	2.5 -	0.3 -
TOC	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH	S.U.	6.9	7.4	7.3	7.3	6.9	7.3	7.3	7.3	6.9	7.3	7.3	7.3	6.0	7.3	7.3
Temperature	°C	23.4	23.4	23.4	23.5	22.5	22.3	22.2	22.3	20.8	20.6	20.8	20.7	22.3	22.8	23.1
DO	mg/L	2.5	5.7	3.2	2.9	3.0	5.5	3.1	2.9	3.0	5.3	2.6	2.3	2.2	4.8	3.1
ORP	mV	3.1	254	266	269	5.7	174	207	229	26.2	198	210	213	318	319	404
Total Chlorine	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	276	263	263
Ca Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	194	182	173
Mg Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	82.1	81.2	89.7
As (total)	µg/L	32.4 -	31.9 -	9.8 -	12.3 -	26.4 -	28.7 -	11.1 -	11.3 -	24.1 -	25.3 -	11.3 -	11.7 -	34.1 -	35.0 -	15.7 -
As (soluble)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	28.4	17.4	13.8
As (particulate)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	5.7	17.6	1.9
As (III)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	23.4	10.5[a]	0.6
As (V)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	5.0	6.9	13.2
Fe (total)	µg/L	2,040 -	2,031 -	<25 -	<25 -	2,104 -	2,001 -	<25 -	<25 -	2,082 -	2,115 -	<25 -	<25 -	1,999 -	1,972 -	<25 -
Fe (soluble)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	826	<25	<25
Mn (total)	µg/L	142 -	700 -	355 -	403 -	139 -	346 -	382 -	491 -	142 -	440 -	470 -	463 -	145 -	361[a] -	333 -
Mn (soluble)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	145	331	351

(a) Incomplete oxidation due to low $KMnO_4$ dosage.

Table B-1. Analytical Results from Long-Term Sampling at Arnaudville, LA (Continued)

Sampling Date		10/10/06				10/17/06				10/24/06				10/31/06				11/07/06		
Sampling Location / Parameter	Unit	IN	AC	TA	TB	IN	AC	TA	TB	IN	AC	TA	TB	IN	AC	TA	TB	IN	AC	TT
Alkalinity (as $CaCO_3$)	mg/L	328	343	332	317	337	343	335	333	337	345	337	333	348	359	348	346	328	336	328
		-	-	-	-	-	-	-	-	337	356	333	335	-	-	-	-	-	-	-
Ammonia (as N)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.8	1.7	0.5
Fluoride	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	0.2	0.2
Sulfate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<1	<1
Nitrate (as N)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	<0.05	0.5
P (as P)	µg/L	642	742	278	298	606	699	199	201	646	695	195	196	636	773	221	230	595	734	210
		-	-	-	-	-	-	-	-	627	713	195	197	-	-	-	-	-	-	-
Silica (as SiO_2)	mg/L	42.3	42.4	42.0	42.2	40.0	41.2	42.9	41.8	41.0	42.3	41.3	41.8	40.7	41.9	41.9	41.0	39.8	41.1	40.1
		-	-	-	-	-	-	-	-	40.3	41.7	40.9	39.4	-	-	-	-	-	-	-
Turbidity	NTU	23.0	2.9	0.7	0.7	19.0	3.4	0.5	0.5	24.0	3.3	0.5	0.7	23.0	2.9	0.5	0.6	23.0	3.0	0.5
		-	-	-	-	-	-	-	-	22.0	3.4	0.4	0.3	-	-	-	-	-	-	-
TOC	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH	S.U.	6.9	7.4	7.3	7.3	6.8	7.3	7.3	7.3	6.9	7.3	7.3	7.3	6.9	7.3	7.3	7.3	6.9	7.4	7.3
Temperature	°C	22.3	22.1	22.3	22.2	22.6	22.4	22.5	22.6	19.2	19.1	19.1	19.0	21.7	21.4	21.6	21.6	21.7	21.6	21.6
DO	mg/L	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	2.5	6.0	2.7	2.4	3.4	6.5	3.5	3.0	2.1	5.6	2.2	2.2	3.4	5.8	3.6
ORP	mV	NA[(a)]	140	NA[(a)]	NA[(a)]	32.8	209	232	232	371	355	363	363	424	407	412	408	373	388	385
Total Chlorine	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	308	293	281
Ca Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	196	187	178
Mg Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	112.0	106.0	103.0
As (total)	µg/L	32.6	30.9	14.4	17.7	33.1	35.7	12.3	12.2	39.1	38.9	12.6	12.9	32.9	34.1	11.0	11.1	26.8	30.7	9.0
		-	-	-	-	-	-	-	-	36.9	38.5	12.8	13.1	-	-	-	-	-	-	-
As (soluble)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27.7	10.2	8.6
As (particulate)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	20.5	0.4
As (III)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24.1	1.3	1.3
As (V)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.6	8.9	7.3
Fe (total)	µg/L	1,878	1,669	<25	<25	2,012	2,026	<25	<25	2,457	2,331	<25	<25	2,261	2,224	<25	<25	2,372	2,375	<25
		-	-	-	-	-	-	-	-	2,509	2,294	<25	<25	-	-	-	-	-	-	-
Fe (soluble)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,277	<25	<25
Mn (total)	µg/L	141	345	260	341	153	633	299	382	138	622	383	443	154	793	347	310	173	784	306
		-	-	-	-	-	-	-	-	138	619	384	441	-	-	-	-	-	-	-
Mn (soluble)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	180	322	307

(a) Not measured.

Table B-1. Analytical Results from Long-Term Sampling at Arnaudville, LA (Continued)

Sampling Date		11/14/06				11/28/06				12/05/06			12/19/06				01/01/07			
Sampling Location Parameter	Unit	IN[a]	AC[a]	TA	TB	IN	AC	TA	TB	IN	AC	TT	IN	AC	TA	TB	IN	AC	TA	TB
Alkalinity (as $CaCO_3$)	mg/L	330 -	336 -	324 -	332 -	350 -	363 -	350 -	352 -	337 -	361 -	333 -	347 -	355 -	351 -	355 -	361 -	365 -	359 -	371 -
Ammonia (as N)	mg/L	-	-	-	-	-	-	-	-	1.9	1.8	0.8	-	-	-	-	-	-	-	-
Fluoride	mg/L	-	-	-	-	-	-	-	-	0.2	0.2	0.2	-	-	-	-	-	-	-	-
Sulfate	mg/L	-	-	-	-	-	-	-	-	<1	<1	<1	-	-	-	-	-	-	-	-
Nitrate (as N)	mg/L	-	-	-	-	-	-	-	-	<0.05	<0.05	0.6	-	-	-	-	-	-	-	-
P (as P)	µg/L	651 -	748 -	216 -	217 -	474 -	632 -	154 -	155 -	552 -	717 -	177 -	581 -	741 -	220 -	252 -	569 -	723 -	213 -	221 -
Silica (as SiO_2)	mg/L	39.7 -	40.3 -	39.6 -	40.8 -	42.2 -	43.2 -	43.2 -	42.7 -	39.6 -	40.5 -	40.3 -	41.7 -	42.5 -	42.8 -	42.9 -	41.7 -	42.8 -	41.1 -	43.2 -
Turbidity	NTU	24.0 -	3.1 -	0.3 -	0.4 -	22.0 -	2.5 -	0.4 -	0.7 -	20.0 -	4.6 -	0.5 -	25.0 -	4.2 -	0.9 -	0.9 -	20.0 -	3.2 -	0.7 -	0.6 -
TOC	mg/L	-	-	-	-	-	-	-	-	1.6	1.3	1.2	-	-	-	-	-	-	-	-
pH	S.U.	6.8	7.3	7.4	7.4	6.8	7.3	7.3	7.3	6.9	7.4	7.4	7.0	7.0	NA[a]	7.5	NA[a]	NA[a]	NA[a]	NA[a]
Temperature	°C	20.1	20.1	20.1	20.0	21.9	21.6	21.6	21.7	16.6	16.6	16.8	20.8	20.6	20.7	20.7	NA[a]	NA[a]	NA[a]	NA[a]
DO	mg/L	2.6	5.5	2.9	2.5	2.4	4.9	2.2	2.7	4.7	4.7	4.8	-	-	-	-	NA[a]	NA[a]	NA[a]	NA[a]
ORP	mV	389[b]	359	265	372	403	313	313	318	428	389	391	-	-	-	-	NA[a]	NA[a]	NA[a]	NA[a]
Total Chlorine	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	303	282	273	-	-	-	-	-	-	-	-
Ca Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	206	188	180	-	-	-	-	-	-	-	-
Mg Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	96.7	93.8	93.0	-	-	-	-	-	-	-	-
As (total)	µg/L	36.5 -	36.6 -	12.1 -	12.9 -	27.3 -	31.7 -	10.3 -	10.5 -	35.3 -	37.6 -	12.0 -	29.9 -	33.8 -	13.1 -	13.6 -	36.8 -	37.6 -	14.4 -	14.7 -
As (soluble)	µg/L	-	-	-	-	-	-	-	-	30.4	14.2	11.5	-	-	-	-	-	-	-	-
As (particulate)	µg/L	-	-	-	-	-	-	-	-	4.9	23.4	0.5	-	-	-	-	-	-	-	-
As (III)	µg/L	-	-	-	-	-	-	-	-	26.6	1.7	0.9	-	-	-	-	-	-	-	-
As (V)	µg/L	-	-	-	-	-	-	-	-	3.8	12.5	10.6	-	-	-	-	-	-	-	-
Fe (total)	µg/L	1,981 -	1,920 -	<25 -	<25 -	1,914 -	1,939 -	<25 -	<25 -	2,042 -	2,065 -	<25 -	2,207 -	2,222 -	93[b] -	149[b] -	2,230 -	2,226 -	31[b] -	28[b] -
Fe (soluble)	µg/L	-	-	-	-	-	-	-	-	1,965	<25	<25	-	-	-	-	-	-	-	-
Mn (total)	µg/L	141 -	755 -	225 -	187 -	135 -	545 -	232 -	238 -	150 -	720 -	288 -	155 -	627 -	605[b] -	564[b] -	145 -	536 -	482[b] -	394[b] -
Mn (soluble)	µg/L	-	-	-	-	-	-	-	-	158	474	304	-	-	-	-	-	-	-	-

(a) Not measured.
(b) Mn and Fe levels elevated after acid/base wash and after system returned to service on 12/12/07.

Table B-1. Analytical Results from Long-Term Sampling at Arnaudville, LA (Continued)

Sampling Date		01/09/07			01/16/07				01/24/07				01/30/07			02/06/07[b]			
Sampling Location / Parameter	Unit	IN	AC	TT	IN	AC	TA	TB	IN	AC	TA	TB	IN	AC	TT	IN	AC	TA	TB
Alkalinity (as $CaCO_3$)	mg/L	332	351	354	347	351	349	355	334	339	330	339	351	368	347	338	357	341	346
		-	-	-	-	-	-	-	322	334	326	335	-	-	-	-	-	-	-
Ammonia (as N)	mg/L	1.5	1.7	1.7	-	-	-	-	-	-	-	-	1.9	1.8	1.3	-	-	-	-
Fluoride	mg/L	0.2	0.3	0.2	-	-	-	-	-	-	-	-	0.2	0.2	0.2	-	-	-	-
Sulfate	mg/L	<1	<1	<1	-	-	-	-	-	-	-	-	<1	<1	<1	-	-	-	-
Nitrate (as N)	mg/L	<0.05	<0.05	<0.05	-	-	-	-	-	-	-	-	<0.05	0.1	0.1	-	-	-	-
P (as P)	µg/L	542	717	240	526	700	161	112	574	657	175	179	703	643	211	547	662	216	219
		-	-	-	-	-	-	-	566	668	183	176	-	-	-	-	-	-	-
Silica (as SiO_2)	mg/L	41.3	42.0	42.6	41.4	42.9	41.4	41.7	39.9	41.2	40.6	40.1	38.4	40.8	40.4	39.5	40.5	40.2	38.7
		-	-	-	-	-	-	-	39.4	40.5	40.8	40.7	-	-	-	-	-	-	-
Turbidity	NTU	23.0	3.1	0.8	22.0	3.3	0.5	0.5	22.0	3.3	0.5	0.6	34.0	4.5	0.9	23.0	3.9	0.4	0.5
		-	-	-	-	-	-	-	22.0	3.3	0.5	0.6	-	-	-	-	-	-	-
TOC	mg/L	1.3	1.3	1.2	-	-	-	-	-	-	-	-	1.2	1.4	1.2	1.5	1.6	1.4	1.4
pH	S.U.	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	6.9	7.3	7.5	7.5	6.8	7.4	7.5	7.0	7.0	7.5	7.5
Temperature	°C	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	18.1	18.3	18.2	18.0	18.1	18.1	18.1	17.4	17.7	17.3	17.5
DO	mg/L	NA[a]	NA[a]	NA[a]	3.7	5.6	4.9	4.8	3.2	5.9	4.5	3.8	4.0	6.2	5.1	3.5	4.1	6.2	4.7
ORP	mV	NA[a]	NA[a]	NA[a]	409	392	391	391	420	384	381	386	412	387	371	381	376	389	393
Total Chlorine	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Hardness (as $CaCO_3$)	mg/L	288	247	241	-	-	-	-	-	-	-	-	304	286	273	-	-	-	-
Ca Hardness (as $CaCO_3$)	mg/L	181	151	146	-	-	-	-	-	-	-	-	200	188	182	-	-	-	-
Mg Hardness (as $CaCO_3$)	mg/L	106.6	95.7	95.0	-	-	-	-	-	-	-	-	104.0	97.8	91.4	-	-	-	-
As (total)	µg/L	30.3	32.0	13.2	25.4	28.4	10.7	10.6	34.4	35.9	12.5	13.6	32.8	31.8	12.8	27.1	27.6	13.3	13.9
		-	-	-	-	-	-	-	34.8	36.6	13.5	13.5	-	-	-	-	-	-	-
As (soluble)	µg/L	30.1	19.0	12.5	-	-	-	-	-	-	-	-	35.8	14.6	12.6	-	-	-	-
As (particulate)	µg/L	0.2	13.0	0.7	-	-	-	-	-	-	-	-	<0.1	17.2	0.2	-	-	-	-
As (III)	µg/L	10.2	2.8	0.7	-	-	-	-	-	-	-	-	26.5	4.4	3.2	-	-	-	-
As (V)	µg/L	19.9	16.2	11.8	-	-	-	-	-	-	-	-	9.3	10.2	9.4	-	-	-	-
Fe (total)	µg/L	2,013	2,003	95	2,002	1,974	<25	<25	2,055	1,822	<25	<25	1,285	904	<25	1,640	1,558	<25	<25
		-	-	-	-	-	-	-	2,005	1,826	<25	<25	-	-	-	-	-	-	-
Fe (soluble)	µg/L	1,788	<25	<25	-	-	-	-	-	-	-	-	902	<25	<25	-	-	-	-
Mn (total)	µg/L	147	536	129	133	475	57.7	128	129	468	155	208	105	450	126	105	180	135	150
		-	-	-	-	-	-	-	130	482	156	209	-	-	-	-	-	-	-
Mn (soluble)	µg/L	152	478	156	-	-	-	-	-	-	-	-	28.9	21.4	20.2	-	-	-	-

(a) Not measured. (b) TOC samples analyzed out of hold time.

Table B-1. Analytical Results from Long-Term Sampling at Arnaudville, LA (Continued)

Sampling Date		02/21/07[c]				02/27/07				03/06/07			03/13/07				03/21/07			
Sampling Location Parameter	Unit	IN	AC	TA	TB	IN	AC	TA	TB	IN	AC	TT	IN	AC	TA	TB	IN	AC	TA	TB
Alkalinity (as $CaCO_3$)	mg/L	368 -	339 -	344 -	339 -	345 -	345 -	338 -	321 -	346 -	339 -	346 -	358 -	351 -	346 -	343 -	337 -	332 -	328 -	328 -
Ammonia (as N)	mg/L	-	-	-	-	-	-	-	-	1.9	1.7	1.4	-	-	-	-	-	-	-	-
Fluoride	mg/L	-	-	-	-	-	-	-	-	0.2	0.2	0.2	-	-	-	-	-	-	-	-
Sulfate	mg/L	-	-	-	-	-	-	-	-	<1	<1	<1	-	-	-	-	-	-	-	-
Nitrate (as N)	mg/L	-	-	-	-	-	-	-	-	<0.05	<0.05	<0.05	-	-	-	-	-	-	-	-
P (as P)	µg/L	762 -	755 -	237 -	225 -	752 -	747 -	243 -	241 -	808 -	795 -	241 -	681 -	671 -	195 -	195 -	766 -	770 -	202 -	192 -
Silica (as SiO_2)	mg/L	41.9 -	42.8 -	42.1 -	42.9 -	42.3 -	42.7 -	41.7 -	41.0 -	41.5 -	41.7 -	41.2 -	41.4 -	41.7 -	41.3 -	41.2 -	43.5 -	43.7 -	42.9 -	43.4 -
Turbidity	NTU	22.0 -	7.4 -	0.9 -	0.1 -	9.2[c] -	5.7 -	0.6 -	0.4 -	12.0[c] -	8.1 -	1.0 -	29.0 -	12.0 -	7.2 -	4.4 -	29.0 -	7.2 -	2.7 -	1.3 -
TOC	mg/L	-	-	-	-	-	-	-	-	1.8	1.7	1.7	-	-	-	-	-	-	-	-
pH	S.U.	6.8	7.2	7.3	7.3	6.9	7.3	7.4	7.4	7.0	7.3	7.4	NA[a]	NA[a]	NA[a]	NA[a]	6.9	7.2	7.3	7.3
Temperature	°C	20.7	20.6	20.6	20.6	14.6	NA[a]	19.8	19.8	18.6	18.7	18.6	NA[a]	NA[a]	NA[a]	NA[a]	21.0	20.9	21.0	21.0
DO	mg/L	3.3	3.1	5.5	6.1	2.9	5.8	4.8	5.6	3.8	5.6	5.6	NA[a]	NA[a]	NA[a]	NA[a]	2.3	4.8	5.7	6.0
ORP	mV	406	386	412	412	416	479	445	440	407	416	415	NA[a]	NA[a]	NA[a]	NA[a]	420	448	448	443
Total Chlorine	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	NA[a]	-	NA[a]	-	1.6	-	1.3
Total Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	298	302	263	-	-	-	-	-	-	-	-
Ca Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	193	194	170	-	-	-	-	-	-	-	-
Mg Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	105.0	108.0	92.8	-	-	-	-	-	-	-	-
As (total)	µg/L	43.0 -	41.6 -	19.9 -	18.8 -	32.8 -	32.9 -	17.5 -	17.8 -	39.7 -	41.1 -	19.0 -	35.9 -	37.0 -	15.8 -	16.3 -	40.1 -	39.9 -	19.8 -	18.6 -
As (soluble)	µg/L	-	-	-	-	-	-	-	-	33.5	22.2	15.6	-	-	-	-	-	-	-	-
As (particulate)	µg/L	-	-	-	-	-	-	-	-	6.2	18.9	3.4	-	-	-	-	-	-	-	-
As (III)	µg/L	-	-	-	-	-	-	-	-	29.6	3.2	2.3	-	-	-	-	-	-	-	-
As (V)	µg/L	-	-	-	-	-	-	-	-	3.9	19.0	13.3	-	-	-	-	-	-	-	-
Fe (total)	µg/L	1,522 -	1,460 -	<25 -	<25 -	1,618 -	1,538 -	<25 -	<25 -	1,619 -	1,548 -	<25 -	1,476 -	1,385 -	<25 -	<25 -	1,733 -	1,726 -	<25 -	<25 -
Fe (soluble)	µg/L	-	-	-	-	-	-	-	-	1,460	<25	<25	-	-	-	-	-	-	-	-
Mn (total)	µg/L	103 -	90.2 -	101 -	101 -	196 -	142 -	228[b] -	211[b] -	123 -	120 -	138 -	96.2 -	96.9 -	195 -	198 -	98.9 -	101 -	110 -	103 -
Mn (soluble)	µg/L	-	-	-	-	-	-	-	-	124	117	139	-	-	-	-	-	-	-	-

(a) Not measured. (b) Samples rerun with similar results.

Table B-1. Analytical Results from Long-Term Sampling at Arnaudville, LA (Continued)

Sampling Date		03/26/07				04/03/07				04/10/07			04/17/07				04/30/07			
Sampling Location		IN	AC	TA	TB	IN	AC	TA	TB	IN	AC	TT	IN	AC	TA	TB	IN	AC	TA	TB
Parameter	Unit																			
Alkalinity (as $CaCO_3$)	mg/L	334	329	326	324	335	335	322	325	341	334	336	338	330	326	330	340	340	340	335
		334	324	324	329	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ammonia (as N)	mg/L	-	-	-	-	-	-	-	-	1.8	1.6	1.4	-	-	-	-	-	-	-	-
Fluoride	mg/L	-	-	-	-	-	-	-	-	0.2	0.2	0.2	-	-	-	-	-	-	-	-
Sulfate	mg/L	-	-	-	-	-	-	-	-	<1	<1	<1	-	-	-	-	-	-	-	-
Nitrate (as N)	mg/L	-	-	-	-	-	-	-	-	<0.05	<0.05	0.1	-	-	-	-	-	-	-	-
P (as P)	µg/L	873	788	181	180	751	729	189	184	701	684	190	688	663	181	192	826	799	183	176
		861	818	188	186	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silica (as SiO_2)	mg/L	42.1	41.8	42.1	41.9	40.2	41.3	40.8	40.8	42.2	41.8	42.1	43.2	43.4	43.5	43.6	43.1	43.2	42.9	43.2
		42.6	41.4	41.2	42.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	25.0	5.9	0.1	0.4	21.0	6.7	0.5	0.7	26.0	11.0	2.0	28.0	7.0	0.8	1.3	25.0	16.0	0.7	0.9
		26.0	6.0	0.4	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOC	mg/L	-	-	-	-	-	-	-	-	1.5	1.4	1.3	-	-	-	-	-	-	-	-
pH	S.U.	6.9	7.1	7.2	7.3	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	6.9	7.1	7.2	7.2	NA[a]	NA[a]	NA[a]	NA[a]
Temperature	°C	21.8	21.6	21.7	21.8	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	19.8	20.0	19.9	20.0	NA[a]	NA[a]	NA[a]	NA[a]
DO	mg/L	3.3	5.3	4.5	5.5	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	3.4	5.3	4.2	3.8	NA[a]	NA[a]	NA[a]	NA[a]
ORP	mV	395	334	387	423	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	409	445	479	463	NA[a]	NA[a]	NA[a]	NA[a]
Total Chlorine	mg/L	-	1.7	-	0.5	-	NA[a]	-	NA[a]	-	NA[a]	NA[a]	-	2.5	-	0.9	-	NA[a]	-	NA[a]
Total Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	243	246	253	-	-	-	-	-	-	-	-
Ca Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	165	166	169	-	-	-	-	-	-	-	-
Mg Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	77.1	80.4	83.8	-	-	-	-	-	-	-	-
As (total)	µg/L	40.5	36.5	16.5	16.6	38.1	36.9	16.8	16.2	39.5	38.8	17.7	40.5	39.6	15.9	18.4	39.8	39.3	34.3	32.5
		38.2	37.8	16.4	16.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
As (soluble)	µg/L	-	-	-	-	-	-	-	-	34.1	17.5	16.2	-	-	-	-	-	-	-	-
As (particulate)	µg/L	-	-	-	-	-	-	-	-	5.4	21.3	1.5	-	-	-	-	-	-	-	-
As (III)	µg/L	-	-	-	-	-	-	-	-	30.7	0.8	2.1	-	-	-	-	-	-	-	-
As (V)	µg/L	-	-	-	-	-	-	-	-	3.4	16.7	14.1	-	-	-	-	-	-	-	-
Fe (total)	µg/L	1,959	1,869	<25	<25	1,889	1,810	<25	<25	1,618	1,521	<25	2,595	2,417	<25	<25	2,453	2,205	<25	<25
		2,005	1,886	<25	<25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fe (soluble)	µg/L	-	-	-	-	-	-	-	-	1,693	<25	<25	-	-	-	-	-	-	-	-
Mn (total)	µg/L	113	115	135	130	107	109	109	112	98	97	175	163	164	169	168	151	152	267	281
		116	116	132	129	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mn (soluble)	µg/L	-	-	-	-	-	-	-	-	105	88.8	189	-	-	-	-	-	-	-	-

(a) Not measured.

Table B-1. Analytical Results from Long-Term Sampling at Arnaudville, LA (Continued)

Sampling Date		01/23/08			01/28/08			03/11/08			03/19/08			03/24/08			04/17/08		
Sampling Location Parameter	Unit	IN	AC	TT	IN	AC	TT	IN	AC	TT	IN	AC	TT	IN	AC	TT	IN	AC	TT
Alkalinity (as $CaCO_3$)	mg/L	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Ammonia (as N)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate (as N)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P (as P)	µg/L	- -	- -	- -	- -	- -	- -	- -	- -	- -	804 -	779 -	108 -	832 -	821 -	172 -	- -	- -	- -
Silica (as SiO_2)	mg/L	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Turbidity	NTU	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
TOC	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH	S.U.	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]
Temperature	°C	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]
DO	mg/L	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]
ORP	mV	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]
Total Chlorine	mg/L	-	NA[(a)]	NA[(a)]	-	NA[(a)]	NA[(a)]	-	NA[(a)]	NA[(a)]	-	NA[(a)]	NA[(a)]	-	NA[(a)]	NA[(a)]	-	NA[(a)]	NA[(a)]
Total Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ca Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mg Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
As (total)	µg/L	28.5 -	18.7 -	9.4 -	41.3 -	41.8 -	10.7 -	35.1 -	36.1 -	10.3 -	35.9 -	35.5 -	7.6 -	38.6 -	37.9 -	10.4 -	35.2 -	35.6 -	5.6 -
As (soluble)	µg/L	28.3	11.0	7.9	34.5	11.3	9.2	34.3	9.0	7.7	28.8	8.2	6.3	33.8	9.5	7.9	33.9	6.6	5.2
As (particulate)	µg/L	0.2	7.7	1.6	6.7	30.5	1.5	0.8	27.1	2.6	7.0	27.4	1.3	4.9	28.4	2.5	1.3	29.0	0.4
As (III)	µg/L	12.5	1.2	0.8	13.8	1.0	0.9	24.2	0.9	1.2	28.4	1.3	1.1	27.8	1.2	1.2	24.2	0.3	0.2
As (V)	µg/L	15.8	9.8	7.1	20.8	10.3	8.3	10.0	8.2	6.4	0.5	6.9	5.2	6.0	8.2	6.7	9.7	6.4	5.0
Fe (total)	µg/L	2,303 -	701 -	45.0 -	8,045 -	2,229 -	<25 -	2,445 -	2,520 -	142 -	2,204 -	2,717 -	<25 -	2,274 -	2,752 -	104 -	2,364 -	3,573 -	31.9 -
Fe (soluble)	µg/L	2,462	<25	<25	6,314	<25	<25	2,391	<25	<25	<25	<25	<25	2,410	<25	<25	2,307	<25	<25
Mn (total)	µg/L	133 -	127 -	117 -	195 -	108 -	76.3 -	144 -	138 -	128 -	134 -	131 -	123 -	134 -	133 -	128 -	140 -	150 -	137 -
Mn (soluble)	µg/L	142	127	120	198	90.8	76.4	146	127	125	130	122	124	141	129	133	141	140	134

(a) Not measured.

Table B-1. Analytical Results from Long-Term Sampling at Arnaudville, LA (Continued)

Sampling Date		11/18/08			12/03/08			01/19/09			01/27/09			03/13/09			03/23/09		
Sampling Location Parameter	Unit	IN	AC	TT	IN	AC	TT	IN	AC	TT	IN	AC	TT	IN	AC	TT	IN	AC	TT
Alkalinity (as $CaCO_3$)	mg/L	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Ammonia (as N)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate (as N)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P (as P)	µg/L	726 -	1,717 -	148 -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Silica (as SiO_2)	mg/L	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Turbidity	NTU	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
TOC	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH	S.U.	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]
Temperature	°C	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]
DO	mg/L	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]
ORP	mV	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]
Total Chlorine	mg/L	-	NA[(a)]	NA[(a)]	-	NA[(a)]	NA[(a)]	-	NA[(a)]	NA[(a)]	-	NA[(a)]	NA[(a)]	-	NA[(a)]	NA[(a)]	-	NA[(a)]	NA[(a)]
Total Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ca Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mg Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
As (total)	µg/L	40.9 -	37.6 -	10.5 -	36.2 -	36.9 -	12.3 -	33.0 -	32.5 -	7.4 -	29.7 -	30.9 -	7.9 -	32.9 -	34.4 -	22.8 -	32.5 -	34.0 -	11.1 -
As (soluble)	µg/L	36.6	14.9	8.5	32.3	2.5	4.7	34.9	10.1	7.2	29.3	10.0	7.7	31.7	3.8	12.6	29.4	11.3	9.2
As (particulate)	µg/L	4.2	22.7	2.0	3.9	34.4	7.6	<0.1	22.4	0.2	0.3	20.9	0.2	1.2	30.5	10.2	3.1	22.7	1.9
As (III)	µg/L	34.0	0.9	0.9	30.9	0.8	0.8	1.6	0.5	0.7	27.5	0.7	0.7	30.5	0.9	0.9	23.7	0.3	0.4
As (V)	µg/L	2.6	13.9	7.6	1.3	1.7	3.9	33.3	9.6	6.5	1.9	9.3	7.0	1.2	2.9	11.8	5.7	10.9	8.8
Fe (total)	µg/L	1,983 -	2,132 -	135 -	2,283 -	9,399 -	1,399 -	1,812 -	2,159 -	34 -	1,768 -	2,159 -	26 -	2,317 -	6,003 -	1,763 -	2,052 -	2,487 -	146 -
Fe (soluble)	µg/L	1,960	<25	<25	2,149	26	<25	241	32	<25	1,851	<25	<25	2,228	31.2	<25	1,835	<25	<25
Mn (total)	µg/L	110 -	170 -	156 -	117 -	135 -	109 -	113 -	110 -	105 -	107 -	106 -	99.4 -	124 -	135 -	120 -	123 -	122 -	131 -
Mn (soluble)	µg/L	131	155	157	119	117	107	109	112	109	112	98.6	101	122	102	113	126	111	128

(a) Not measured.

Table B-1. Analytical Results from Long-Term Sampling at Arnaudville, LA (Continued)

Sampling Date		03/30/09			08/18/09			09/01/09			09/09/09			09/15/09			09/28/09		
Sampling Location Parameter	Unit	IN	AC	TT	IN	AC	TT	IN	AC	TT	IN	AC	TT	IN	AC	TT	IN	AC	TT
Alkalinity (as $CaCO_3$)	mg/L	- -	- -	- -	326 -	324 -	315 -	318 -	323 -	316 -	323 -	309 -	305 -	307 -	294 -	302 -	322 -	314 -	308 -
Ammonia (as N)	mg/L	-	-	-	1.9	1.7	1.5	1.9	1.6	1.6	1.9	1.3	1.3	1.9	1.4	1.6	2.0	0.9	1.2
Fluoride	mg/L	-	-	-	0.3	0.2	0.7	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3
Sulfate	mg/L	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrate (as N)	mg/L	-	-	-	<0.05	<0.05	0.1	<0.05	<0.05	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.1	0.1
P (as P)	μg/L	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Silica (as SiO_2)	mg/L	- -	- -	- -	44.4 -	44.9 -	44.6 -	46.4 -	46.8 -	47.0 -	45.8 -	46.8 -	47.1 -	45.1 -	45.3 -	45.3 -	46.5 -	47.2 -	47.3 -
Turbidity	NTU	- -	- -	- -	32.0 -	5.9 -	0.3 -	29.0 -	2.3 -	0.5 -	32.0 -	2.0 -	0.5 -	31.0 -	2.3 -	0.4 -	32.0 -	2.0 -	0.1 -
TOC	mg/L	-	-	-	1.8	1.4	1.3	1.6	1.6	1.6	1.6	2.4	1.4	1.8	1.7	1.6	1.3	1.4	1.3
pH	S.U.	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]
Temperature	°C	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]
DO	mg/L	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]
ORP	mV	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]
Total Chlorine	mg/L	-	NA[(a)]	NA[(a)]	-	NA[(a)]	NA[(a)]	-	NA[(a)]	NA[(a)]	-	NA[(a)]	NA[(a)]	-	NA[(a)]	NA[(a)]	-	NA[(a)]	NA[(a)]
Total Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	273	281	275	274	266	255	242	231	225	267	258	256
Ca Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	175	183	179	175	170	160	149	142	138	180	172	172
Mg Hardness (as $CaCO_3$)	mg/L	-	-	-	-	-	-	98.3	97.8	96.5	99.8	96.0	94.7	92.2	89.2	87.7	86.9	85.5	84.9
As (total)	μg/L	32.7 -	32.0 -	16.4 -	30.8 -	34.1 -	9.9 -	30.2 -	33.6 -	7.3 -	28.3 -	31.5 -	7.4 -	29.9 31.5	32.4 30.9	1.4 -	32.7 -	33.8 -	9.4 -
As (soluble)	μg/L	32.7	32.0	16.4	30.9	11.2	9.3	29.7	11.6	8.9	28.4	10.5	8.5	25.0	2.2	0.3	30.5	10.5	9.6
As (particulate)	μg/L	0.1	17.1	5.1	<0.1	22.9	0.6	0.5	22.0	<0.1	<0.1	20.9	<0.1	4.9	30.2	1.1	2.2	23.3	<0.1
As (III)	μg/L	31.9	0.8	0.9	12.3	1.5	1.3	19.5	0.5	0.3	20.1	0.7	<0.1	20.1	0.9	0.4	26.4	0.5	0.5
As (V)	μg/L	0.8	14.0	10.4	18.5	9.7	8.0	10.2	11.1	8.6	8.4	9.9	8.4	4.9	1.3	<0.1	4.2	10.0	9.1
Fe (total)	μg/L	2,332 -	2,423 -	824 -	1,854 -	1,892 -	41 -	1,838 -	1,790 -	<25 -	1,775 -	1,704 -	87 -	1,805 2,114	1,758 2,067	69 -	1,938 -	1,856 -	27 -
Fe (soluble)	μg/L	2,280	<25	<25	1,904	118	<25	1,966	<25	<25	1,857	<25	<25	1,881	<25	<25	1,958	<25	<25
Mn (total)	μg/L	112 -	107 -	77.7 -	164 -	113 -	110 -	112 -	112 -	103 -	110 -	107 -	103 -	115 139	114 134	107 -	119 -	116 -	110 -
Mn (soluble)	μg/L	112	93.5	97.9	165	107	106	117	96.3	105	113	25.2	111	116	108	107	118	99	116

(a) Not measured.

Table B-1. Analytical Results from Long-Term Sampling at Arnaudville, LA (Continued)

Sampling Date		10/05/09			10/13/09			10/19/09			10/26/09			11/03/09			11/09/09		
Sampling Location Parameter	Unit	IN	AC	TT	IN	AC	TT	IN	AC	TT	IN	AC	TT	IN	AC	TT	IN	AC	TT
Alkalinity (as $CaCO_3$)	mg/L	311 -	309 -	311 -	321 -	308 -	313 -	310 -	308 -	314 -	290 -	297 -	305 -	329 -	325 -	320 -	319 -	326 -	328 -
Ammonia (as N)	mg/L	2.1	1.6	1.6	2.0	1.4	1.4	2.0	1.8	1.9	2.0	1.8	1.9	2.0	1.8	1.6	2.0	1.6	1.6
Fluoride	mg/L	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.1
Sulfate	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrate (as N)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	0.1	<0.05	<0.05	<0.05
P (as P)	μg/L	- -	- -	- -	706 -	715 -	323 -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Silica (as SiO_2)	mg/L	44.1 -	45.0 -	45.0 -	42.0 -	42.6 -	41.6 -	41.8 -	42.6 -	42.4 -	45.9 -	46.6 -	47.7 -	44.0 -	44.3 -	44.7 -	47.1 -	48.5 -	47.6 -
Turbidity	NTU	32.0 -	2.6 -	0.9 -	31.0 -	2.7 -	0.5 -	32.0 -	2.1 -	0.7 -	30.0 -	2.2 -	1.0 -	26.0 -	2.0 -	0.9 -	30.0 -	2.0 -	2.1 -
TOC	mg/L	1.0	1.0	1.1	1.0	1.1	<1	<1.0	1.0	<1.0	1.1	1.2	1.1	1.1	1.1	1.3	1.4	1.5	1.4
pH	S.U.	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]
Temperature	°C	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]
DO	mg/L	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]
ORP	mV	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]	NA[(a)]
Total Chlorine	mg/L	-	NA[(a)]	NA[(a)]	-	NA[(a)]	NA[(a)]	-	NA[(a)]	NA[(a)]	-	NA[(a)]	NA[(a)]	-	NA[(a)]	NA[(a)]	-	NA[(a)]	NA[(a)]
Total Hardness (as $CaCO_3$)	mg/L	264	253	251	292	277	286	315	307	309	420	417	415	440	438	439	206	206	205
Ca Hardness (as $CaCO_3$)	mg/L	177	168	167	192	181	189	231	231	225	302	301	298	316	316	316	108	111	110
Mg Hardness (as $CaCO_3$)	mg/L	87.9	84.8	83.8	100	96.0	97.8	84.0	76.2	83.3	118	116	117	124	122	124	97.2	95.1	95.5
As (total)	μg/L	33.8 32.1	34.6 -	18.6 -	32.4 -	32.2 -	14.9 -	31.0 -	32.2 -	10.5 -	27.2 -	28.6 -	10.8 -	26.4 -	27.9 -	10.2 -	35.4 -	35.5 -	12.8 -
As (soluble)	μg/L	11, 11.5	31.0, 31.3	8.8	28.5	9.6	7.1	28.6	15.4, 16.4	8.5	26.5	10.5	8.9	25.8	8.9	9.8	33.9	12.4	9.7
As (particulate)	μg/L	22.7	3.6	9.8	3.9	22.6	7.8	2.4	16.8	1.9	0.7	18.1	1.9	0.6	19.0	0.3	1.5	23.1	3.1
As (III)	μg/L	0.4, 0.7	27.0, 30.2	0.6	26.8	<0.1	<0.1	27.8	<0.1, 0.52	0.3	24.2	0.3	0.1	24.0	<0.1	0.3	32.3	1.2	1.3
As (V)	μg/L	10.6	3.7	8.2	1.7	9.5	7.0	0.8	15.4	8.2	2.3	10.2	8.8	1.9	8.8	9.6	1.5	11.2	8.4
Fe (total)	μg/L	2,054 2,364	1,825 -	790 -	2,283 -	2,122 -	732 -	2,050 -	2,305	120 -	2,005 -	2,042 -	191 -	2,072 -	2,134 -	325 -	2,373 -	2,411 -	235 -
Fe (soluble)	μg/L	<25, 25.5	1956, 2165	<25	2,203	<25	<25	2,362	<25, <25	<25	2,176	25	<25	2,155	<25	<25	2,452	28.0	<25
Mn (total)	μg/L	119 134	116 -	116 -	119 -	115 -	119 -	134 -	136 -	125 -	108 -	107 -	104 -	111 -	109 -	104 -	150 -	142 -	133 -
Mn (soluble)	μg/L	104, 119	122, 135	113	119	110	116	138	111, 113	130	114	105	105	115	102	90.8	144	129	135

(a) Not measured.

Table B-1. Analytical Results from Long-Term Sampling at Arnaudville, LA (Continued)

Sampling Date		11/17/09			12/08/09			01/05/10			01/11/10		
Sampling Location Parameter	Unit	IN	AC	TT	IN	AC	TT	IN	AC	TT	IN	AC	TT
Alkalinity (as $CaCO_3$)	mg/L	342 -	329 -	324 -	335 -	330 -	326 -	334 -	343 -	350 -	336 -	331 -	340 -
Ammonia (as N)	mg/L	1.8	1.5	1.5	1.9	1.7	0.2	2.1	1.8	1.8	1.9	1.9	1.9
Fluoride	mg/L	0.2	0.2	0.2	0.2	0.2	0.8	0.3	0.2	0.3	0.2	0.2	0.2
Sulfate	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrate (as N)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
P (as P)	µg/L	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Silica (as SiO_2)	mg/L	48.3 -	47.7 -	47.0 -	43.5 -	44.8 -	45.2 -	46.7 -	47.9 -	48.4 -	45.0 -	46.6 -	46.9 -
Turbidity	NTU	26.0 -	1.9 -	0.4 -	30.0 -	1.7 -	0.8 -	38.0 -	2.4 -	0.3 -	31.0 -	3.2 -	1.4 -
TOC	mg/L	1.2	1.2	1.1	1.9	1.1	<1	<1.0	1.1	1.0	1.2	1.1	<1.0
pH	S.U.	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]
Temperature	°C	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]
DO	mg/L	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]
ORP	mV	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]
Total Chlorine	mg/L	-	NA[a]	NA[a]	-	NA[a]	NA[a]	-	NA[a]	NA[a]	-	NA[a]	NA[a]
Total Hardness (as $CaCO_3$)	mg/L	193	198	187	244	229	222	263	253	246	277	277	278
Ca Hardness (as $CaCO_3$)	mg/L	103	106	100	162	153	149	173	168	163	180	190	188
Mg Hardness (as $CaCO_3$)	mg/L	89.4	91.4	86.5	82.1	75.8	72.3	90.2	85.0	83.0	96.2	87.3	90.1
As (total)	µg/L	42.4 -	41.8 -	13.8 -	27.9 -	27.2 -	3.9 -	27.7 -	31.1 -	18.1 -	28.3 -	28.9 -	14.3 -
As (soluble)	µg/L	37.7	14.3	12.1	27.9	9.3	3.9	28.1	10.8	9.5	28.1	14.4	14.3
As (particulate)	µg/L	4.7	27.4	1.7	<0.1	17.9	<0.1	<0.1	20.3	8.5	0.2	14.5	<0.1
As (III)	µg/L	35.2	1.6	1.6	24.0	0.6	0.8	28.1	1.2	1.1	27.9	1.1	2.2
As (V)	µg/L	2.5	12.7	10.5	3.8	8.7	3.1	<0.1	9.5	8.5	0.2	13.3	12.1
Fe (total)	µg/L	2,255 -	2,264 -	118 -	1,959 -	1,902 -	52 -	2,939 -	2,701 -	1037 -	2,076 -	2,154 -	117 -
Fe (soluble)	µg/L	2,337	<25	<25	1,903	<25	<25	3,276	35	<25	2,238	31	<25
Mn (total)	µg/L	138 -	136 -	117 -	123 -	114 -	99.9 -	144 -	132 -	106 -	121 -	116 -	106 -
Mn (soluble)	µg/L	131	116	113	125	114	104	151	124	103	127	115	117

(a) Not measured.

Table B-1. Analytical Results from Long-Term Sampling at Arnaudville, LA (Continued)

Sampling Date		01/22/10					02/01/10			02/09/10			08/05/10		
Sampling Location Parameter	Unit	IN	AC	TA	TB	TT	IN	AC	TT	IN	AC	TT	IN	AC	TT
Alkalinity (as $CaCO_3$)	mg/L	314 -	325	332	336 -	321 -	316 -	332 -	330 -	343 -	334 -	352 -	318 -	327 -	313 -
Ammonia (as N)	mg/L	2.0	1.9	1.9	1.9	1.9	2.0	1.9	1.9	1.9	1.9	2.0	2.0	1.8	1.8
Fluoride	mg/L	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Sulfate	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrate (as N)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
P (as P)	µg/L	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Silica (as SiO_2)	mg/L	49.3 -	50.0 -	50.1 -	49.6 -	49.6 -	48.2 -	49.0 -	48.9 -	45.5 -	46.8 -	46.4 -	47.0 -	47.8 -	48.7 -
Turbidity	NTU	14.0 -	4.2 -	0.3 -	0.6 -	0.4 -	31.0 -	4.9 -	0.4 -	29.0 -	4.8 -	0.6 -	31.0 -	33.0 -	0.4 -
TOC	mg/L	1.5	1.3	1.3	1.2	1.3	1.5	1.7	1.5	1.7	1.5	1.4	1.6	1.7	1.6
pH	S.U.	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]
Temperature	°C	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]
DO	mg/L	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]
ORP	mV	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]
Total Chlorine	mg/L	-	NA[a]	NA[a]	NA[a]	NA[a]	-	NA[a]	NA[a]	-	NA[a]	NA[a]	-	NA[a]	NA[a]
Total Hardness (as $CaCO_3$)	mg/L	219	216	214	222	224	211	226	226	275	272	282	100	93.9	93.5
Ca Hardness (as $CaCO_3$)	mg/L	130	129	128	133	134	128	141	143	181	182	189	1.8	2.1	0.4
Mg Hardness (as $CaCO_3$)	mg/L	88.8	87.5	86.2	89.0	90.6	82.3	84.5	83.4	93.7	89.5	92.3	98.6	91.8	93.2
As (total)	µg/L	27.0 -	29.6 -	9.4 -	10.9 -	5.2 -	25.1 -	27.9 -	12.4 -	29.5 -	30.7 -	12.4 -	31.9 -	32.9 -	6.7 -
As (soluble)	µg/L	27.8	13.3	9.6	9.8	9.3	26.2	13.3	12.1	29.8	13.3	11.1	33.0	11.8	7.2
As (particulate)	µg/L	<0.1	16.3	<0.1	1.1	<0.1	<0.1	14.5	0.3	<0.1	17.5	1.3	<0.1	21.1	<0.1
As (III)	µg/L	27.3	1.8	1.5	1.4	5.6	25.4	2.0	1.8	29.0	1.1	1.0	31.2	0.3	0.2
As (V)	µg/L	0.5	11.4	8.0	8.4	3.7	0.7	11.4	10.3	0.8	12.1	10.2	1.8	11.5	7.0
Fe (total)	µg/L	2,386 -	2,273 -	60 -	124 -	83 -	2,245 -	2,271 -	51 -	2,270 -	2,219 -	192 -	2,455 -	2,573 -	<25 -
Fe (soluble)	µg/L	2,403	72	<25	<25	<25	2,322	111	<25	2,404	25	<25	2,485	<25	<25
Mn (total)	µg/L	143 -	138 -	132 -	124 -	132 -	157 -	149 -	137 -	133 -	134 -	128 -	150 -	224 -	156 -
Mn (soluble)	µg/L	149	136	135	136	137	156	143	140	144	131	130	151	254	156